China State Construction Engineering (HK) Ltd.

Kowloon Southern Link – KDB300 and KDB400 Tunnels, Jordan Road to Nam Cheong Station Overrun

Working Plan for Groundwater Monitoring

October 2006

Report no: 01273R0066

Hyder Consulting Ltd
COI Number 126012
47th Floor, Hopewell Centre, 183 Queens Road East, Wanchai, Hong Kong
Tel: +852 2911 2233 Fax: +852 2805 5028 www.hyderconsulting.com

Hyder Consulting

China State Construction Engineering (HK) Ltd.

Kowloon Southern Link – KDB300 and KDB400 Tunnels, Jordan Road to Nam Cheong Station Overrun

Working Plan for Groundwater Monitoring

Author: Adi Lee

Checker: Coleman Ng

Approver: Coleman Ng

Report no: 01273R0066 **Date:** October 2006

Hyder Consulting

Certified by Environmental Team Leader
Ir. Coleman Ng

Contents

1 Background 1

2 Groundwater Monitoring Approach 2

2.1 Ambient Groundwater Monitoring 2
2.2 Groundwater Monitoring Phases 4

3 Dewatering Works 5

3.1 Dewatering Works at KDB400 5
3.2 Dewatering Rate 5

4 Location of Sampling Wells 6

4.1 Ambient Groundwater Monitoring Wells 6
4.2 Recharge Well 8
4.3 Monitoring Well 8
4.4 Control Well 8

5 Monitoring Methodology 12

5.1 Baseline Monitoring 12
5.2 Impact Monitoring 13
5.3 Sampling Method 14
5.4 Sample Handling 15

6 Baseline Monitoring Results 15

6.1 Monitoring Results 15
6.2 Extent of Contamination 17

7 Event and Action Plan 18

7.1 Limit Level 18
7.2 Event and Action Plan 19

8 Groundwater Treatment 20

9 Additional Groundwater Monitoring Works 22

Tables

Table 3-1	Tentative Schedule of Dewatering Works and Respective Dewatering Rate	6
Table 4-2	Recharge Areas and Monitoring Locations	9
Table 5-3	Baseline Groundwater Testing Parameters	13

Table 6-4	Summary of Baseline Groundwater Monitoring Results	16
Table 7-5	Limit Levels of TPH at Recharge Wells/Outlet of Treatment Facilities	18
Table 7-6	Limit Levels at Monitoring Wells	19
Table 7-7	Event and Action Plan	20
Table 8-8	Number of Treatment Facilities	21

Figures

Figure 4-1	Sections of Construction Site of KSL Contracts	10
Figure 4-2	Groundwater Sampling Locations in KSL EIA	11
Figure 8-3	Schematic Process of Groundwater Treatment	22

Annex

Annex 1	Locations of Dewatering Areas, Recharge Areas and Dewatering Rates
Annex 2	Analytical Results of Five Sampling Location in EIA Stage
Annex 3	Information of Old Seawall
Annex 4	Site Layout of KDB400
Annex 5	Typical Installation Details of Groundwater Monitoring Well
Annex 6	Baseline Monitoring Results

1 Background

A Contamination Assessment Report (CAR) and Remediation Action Plan (RAP) for the site of KCRC Kowloon Southern Link (KSL) (Appendix 10.2 of the KSL EIA Report) were prepared. Groundwater at some spots of the KSL alignment was found contaminated with primarily heavy metals (i.e. Copper, Lead and Mercury) of which their levels exceeded the Dutch C level for groundwater. Within the construction sites of KDB300 & KDB400, water sample collected at borehole KSD100/DHEPZ113 in the vicinity of Tai Kok Tsui petrol filling station at Skyway House exceeded the discharge limit as stipulated in Technical Memorandum on Standards for Effluents Discharged into Drainage and Sewerage Systems, Inland and Coastal Waters (TM) and Dutch C Levels as indicated in KSL EIA Report.

According to the KSL EIA Report and Further Environmental Permits (FEPs) (EP No. FEP-02/215/2005/A and FEP-03/215/2005/A) for KDB300 & KDB400, direct discharge of contaminated groundwater will not be adopted. Contaminated groundwater should be diverted to pre-determined well(s) for recharging back to the ground. In accordance with the KSL EIA Report and EM&A Manual, recharge wells should be selected at places where the groundwater quality will not be affected by recharge operation. According to Conditions 3.4 and 3.5 of the FEPs for KDB300 and KDB400 respectively, a Working Plan (WP) including number of recharge wells and their specific locations, baseline parameters of the recharge and monitoring locations, and number of treatment facilities and their treatment capacities should be prepared and submitted to EPD prior to dewatering works.

According to the KSL EIA Report and EM&A Manual, ambient measurements on the groundwater quality at the WKN and the cut-&-cover tunnel to the north of WKN prior to the selection of recharge wells is required. The measurement results will be used to update the potential of groundwater contamination and to form groundwater baseline condition. After performing the ambient groundwater quality measurement, recharge wells would be selected for recharging contaminated groundwater.

This Working Plan (WP) is prepared to:

- Describe general approach of groundwater monitoring works;
- Identify ambient groundwater monitoring locations;
- Formulate ambient/baseline groundwater monitoring programme and stipulate monitoring parameters, reporting limits and analytical method for the ambient, recharge and monitoring locations;
- Update the extent of potential groundwater contamination;
- Identify possible areas for recharging groundwater, locations of recharge wells, impact monitoring wells and control wells;
- Formulate the impact monitoring programme including Limit Level of impact monitoring and Event and Action Plan;

- Describe the requirements of groundwater monitoring wells, sampling methodology and sample handling requirements; and
- Identity the number and capacity of the treatment facility required.

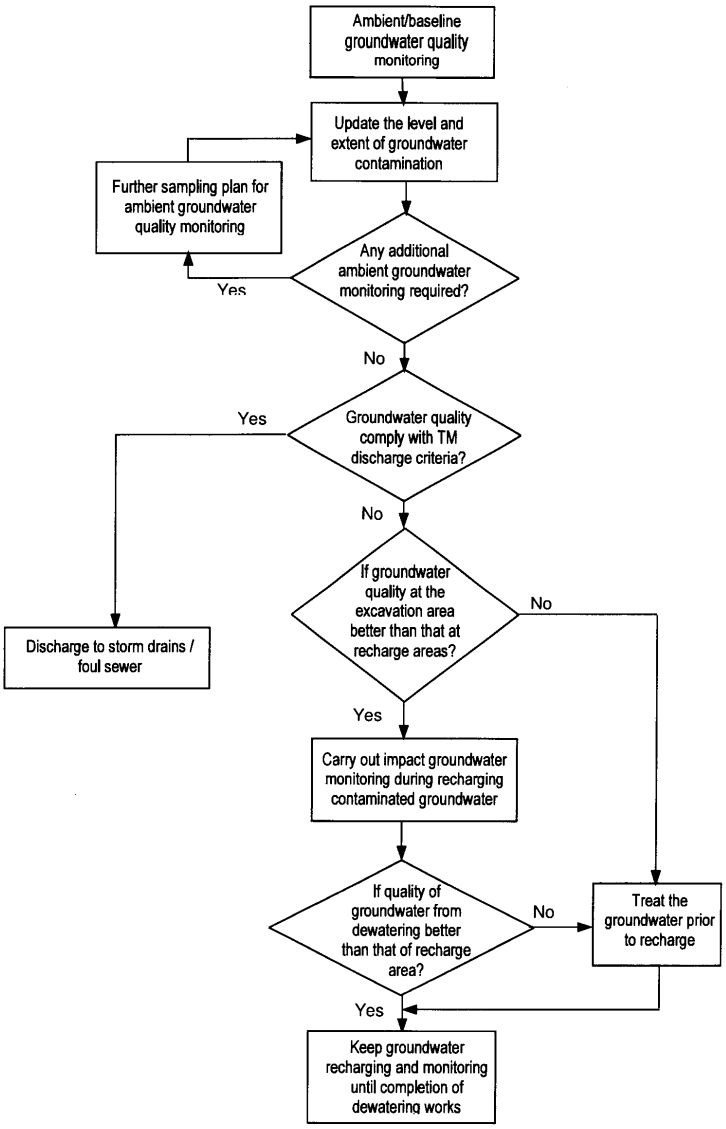
2 Groundwater Monitoring Approach

2.1 Ambient Groundwater Monitoring

According to the KSL EIA Report and EM&A Manual, ambient groundwater monitoring should be carried out for updating the extent of the groundwater contamination identified in the KSL EIA report. The ambient groundwater monitoring will also form part of the baseline groundwater monitoring of the groundwater monitoring programme for recharging contaminated groundwater.

Groundwater would be considered as contaminated if it cannot comply with the discharge limits of the relevant flow band as stipulated in Table 9a – Standards for Effluent Discharged into the Inshore Waters of VHWCZ of the TM and it contains any prohibited substance listed in Section 9.2 of the TM.

The following diagram shows the approach of the groundwater monitoring works.


Ambient/baseline groundwater quality monitoring
Update the level and extent of groundwater contamination
Further sampling plan for ambient groundwater quality monitoring
Any additional ambient groundwater monitoring required?
Yes
No
Groundwater quality comply with TM discharge criteria?
Yes
No
Discharge to storm drains / foul sewer
If groundwater quality at the excavation area better than that at recharge areas?
No
Yes
Carry out impact groundwater monitoring during recharging contaminated groundwater
If quality of groundwater from dewatering better than that of recharge area?
No
Treat the groundwater prior to recharge
Yes
Keep groundwater recharging and monitoring until completion of dewatering works

2.2 Groundwater Monitoring Phases

Groundwater monitoring for recharging groundwater work will be separated into baseline and impact phases.

2.2.1 Baseline Groundwater Monitoring

Baseline monitoring will be undertaken at the following monitoring wells:

I. Ambient Groundwater Quality Monitoring Well

II. Recharge Well

III. Control Well

IV. Impact Monitoring Well

Groundwater samples from the above wells will be collected daily for 7 consecutive days. Monitoring will be carried out at ambient groundwater monitoring wells to determine the level and extent of groundwater contamination, if any. If ambient groundwater monitoring results show that the groundwater quality does not comply with the discharge limits or contains prohibited substances as stipulated in TM, baseline monitoring will also be carried out at recharge well(s), control well(s) and impact monitoring well(s). Based on the baseline monitoring results, limit levels will be established once the analytical results are available based on the followings:

- Ambient groundwater quality measurement results; and
- The groundwater quality of the monitoring wells at the site boundaries will not be affected by the recharging operation.

2.2.2 Impact Groundwater Monitoring

Impact monitoring will be carried out at the recharge wells and monitoring wells in order to ensure the quality of groundwater from dewatering is better than that of the recharge areas. In addition, monitoring will also be carried out at the control well for monitoring the natural variation of groundwater quality.

In case of any exceedance, appropriate action will be undertaken in accordance with the Event and Action Plan as described in Table 7-4.

3 Dewatering Works

3.1 Dewatering Works at KDB400

KSL railway will be laid underground and will be constructed by cut-&-cover. Excavation and dewatering works along the alignment will be required and will be carried out in separate zones within KDB400. Each of the excavation areas will be surrounded by cofferdam walls (by means of sheet-pile or pipe-pile) which restrict the seepage of groundwater into the excavation zones. The first zone of where excavation works will be carried out is Zone A at Nam Cheong Park as shown in Annex 1.

Two site areas have been identified for recharging the groundwater from dewatering process. Groundwater from Zones A to D will be recharged to recharge area at Nam Cheong Park near Zone A. Groundwater from Zones E to G will be recharged to recharge area adjacent the KSL alignment near the construction site of Olympic City Phase III near Zone F. Annex 1 also shows the identified recharge areas and tentative programme for dewatering works of Zones A to G.

3.2 Dewatering Rate

Dewatering rate depends on the dewatering requirement of each phase of dewatering works. In general, dewatering works will be separated into two phases. Phase I dewatering works include pumping test and full drawn-down of water table and phase II dewatering works control the seepage of groundwater during excavation and tunnel construction works. The estimated average hourly dewatering rate of the dewatering well and the daily dewatering rate of dewatering zones in different phases are given in Annex 1. As dewatering works of different zones will be overlapped in certain time periods, the estimated daily groundwater dewatering rates at different time periods are summarised in Table 3-1.

Period	Zone	Dewatering Works		Estimated Dewatering Rate, m³/day	Recharge Area
		Pumping Test and Draw-down Water Table	Seepage Control		
16 Oct 06 to 31 Oct 06	A	✓		960	Recharge area at Nam Cheong Park near Zone A
1 Nov 06 to 30 Nov 06	A		✓	320	
1 Dec 06 to 15 Dec 06	A		✓	1,664	
	B	✓			
16 Dec 06 to 31 Dec 06	A		✓	1,920	
	B		✓		
	C	✓			
1 Jan 07 to 15 Jan 07	A		✓	1,152	
	B		✓		
	C		✓		
16 Jan 07 to 31 Jan 07	A		✓	2,304	
	B		✓		
	C		✓		
	D	✓			
1 Feb 07 to 30 Jun 07	A		✓	1,536	
	B		✓		
	C		✓		
	D		✓		
1 Feb 07 to 15 Feb 07	E	✓		1,536	Recharge area adjacent the KSL alignment near the construction site of Olympic City Phase III near Zone F
16 Feb 07 to 28 Feb 07	E		✓	2,240	
	F	✓			
1 March 07 to 15 March 07	E		✓	3,200	
	F		✓		
	G	✓			
15 March 07 to 30 Sep 07	E		✓	1,792	
	F		✓		
	G		✓		

Table 3-1 Tentative Schedule of Dewatering Works and Respective Dewatering Rate

4 Location of Sampling Wells

4.1 Ambient Groundwater Monitoring Wells

According to the KSL EIA report, six sampling locations were identified at five identified potential contaminated areas. Figure 4-1 shows the sections of the construction sites of KSL Contracts KDB200, KDB300 and KDB400. Figure 4-2 shows five groundwater sampling locations identified in the KSL

EIA report. Only two sampling locations (KSD100/DHEPZ113 and KSD100/DHE120) are located within the construction site of KDB400. There was no potential contaminated area identified in the construction site of KDB300. The analytical results of these five locations extracted from the EIA report are given in Annex 2.

Groundwater sample from the borehole KSD100/DHEPZ113 in the vicinity of Tai Kok Tsui petrol filling station at Skyway House exceeded the discharge limit of Mercury as stipulated in TM. TPH (C15-C28) was also present in the groundwater sample. As the testing for TPH (C10-C14 and C29-C36), PAHs and BTEX in the EIA study was not up to the required reporting limits, such substances might also be present in the sample.

TPH (C15-C28 and C29-C36) was present in the groundwater sample at borehole KSD100/DHE120 which is located at the former shipyard site in West Kowloon Reclamation Area. Moreover, as the testing for TPH (C10-C14), PAHs and BTEX in the EIA study was not up to the required reporting limits, such substances might also be present in the sample.

Annex 3 shows that there is an old seawall down to –5mPD (approximate 11m below ground level) at Chainage 6+950* (at about the northern end of MTR Olympic Station and the Chainage is referred to Site Layout for KDB400 (Drawing no.: KDB400/HA/Y0001 rev A) as given in Annex 4). This would potentially restrict the migration of groundwater across the seawall.

For updating the extent of the groundwater contamination and evaluate the groundwater quality at the excavation areas, the ambient groundwater quality monitoring wells are located between Chainage 6+950* and Chainage 7+200* (where is midway between boreholes KSD100/DHEPZ113 and KSD100/DHE120). Six ambient groundwater quality monitoring wells, AGM 1 to AGM 6, along the alignment are shown in Annex 1.

In addition, one ambient groundwater well (AGM 7) has been identified in the vicinity of KSD100/DHE120 as shown in Annex 1 to update the groundwater contamination at the site of Nam Cheong Park.

All of these ambient groundwater wells are located at the excavation areas where dewatering works will be undertaken to the north of the old seawall. Thus AGM1 to AGM7 can represent the groundwater quality from Zone A to Zone G.

* All Chainages are referred to Site Layout for KDB 400 (Drawing no.: KDB400/HA/Y001 rev A) as given in Annex 2.

4.2 Recharge Well

Two recharge areas locating recharging wells for groundwater recharge operation were identified. Recharge areas near Zone F and Zone A are identified for recharging groundwater from Zone E to Zone G and Zone A to Zone D respectively. Two recharge well locations, R1 and R2, for evaluating the groundwater contamination at recharge areas were identified as shown in Annex 1. R1 is located at the site area adjacent the KSL alignment near the construction site of Olympic City Phase III near Zone F and R2 is located within the construction site of Nam Cheong Park near Zone A.

Pit will be constructed at each recharge area as it is not practicable that recharge groundwater from dewatering works into a single recharge well. The adequacy of the recharge well to accommodate the dewatered groundwater would be subject to the soil permeability data which will be obtained from the pumping test. Pit will be enlarged or additional recharge area will be identified if it is found that the pit at the recharge area is not sufficient to accommodate the dewatered groundwater.

As mentioned in Section 3.1, cofferdam wall will be constructed surrounding the excavation zones to restrict the groundwater seepage. This would also restrict the groundwater recharged to R1 and R2 to migrate seaward across the alignment. Thus, monitoring and control wells as mentioned below are also located to the east side of the KSL alignment where R1 and R2 are located.

4.3 Monitoring Well

Monitoring well locations, M1/AGM5a, M2, M2a and M3, are identified at the site boundary near the recharge wells as shown in Annex 1 for ensuring there is no likelihood of locally risen groundwater level and transfer of pollutants beyond the site boundary. Due to site constraint, M2 was used for obtaining the baseline groundwater quality near the site boundary while M2a will be the actual monitoring location during impact monitoring.

4.4 Control Well

Control well will be used to monitor the natural variation of the groundwater quality. Groundwater quality should not be affected by excavation works and recharge operation. Three control wells, C1, C2 and C3, are identified for groundwater monitoring during the recharge operation and they are shown in Annex 1.

The control wells have been identified at the best available locations with the consideration of the followings in order to ensure that the groundwater quality at control wells can represent natural variation but not affecting the KSL construction works:

- excavation and dewatering works;
- recharge operation;
- limited site area (as the site area railway construction is narrow); and
- most of the suitable areas are existing roads and slopes which are not suitable for locating sampling well.

C1 will be used as control well for recharge operation for Zones A and B. C2/C3 will be used as control well for Zones C and D as M2a/M3 will be used as monitoring wells during recharge operation for Zones C and D. For recharge operation for Zones E to G, as M1/AGM5a (to be renamed as M4) will be used as monitoring well, C2/C3 will be used as control well.

Table 4-2 shows the respective recharge areas, monitoring wells and control wells for the recharge operation for different excavation zones.

Zone	Dewatering Period	Recharge Area/Well	Monitoring Well	Control Well
Zone A	1 Oct 06 to 30 June 07	R2	M2a	C1
Zone B		R2	M2a	C1
Zone C		R2	M2a/M3	C2/C3
Zone D		R2	M2a/M3	C2/C3
Zone E	1 Feb 06 to 30 Sep 07	R1	M1/AGM5a (M4)	C2/C3
Zone F		R1	M1/AGM5a (M4)	C2/C3
Zone G		R1	M1/AGM5a (M4)	C2/C3

Table 4-2 Recharge Areas and Monitoring Locations

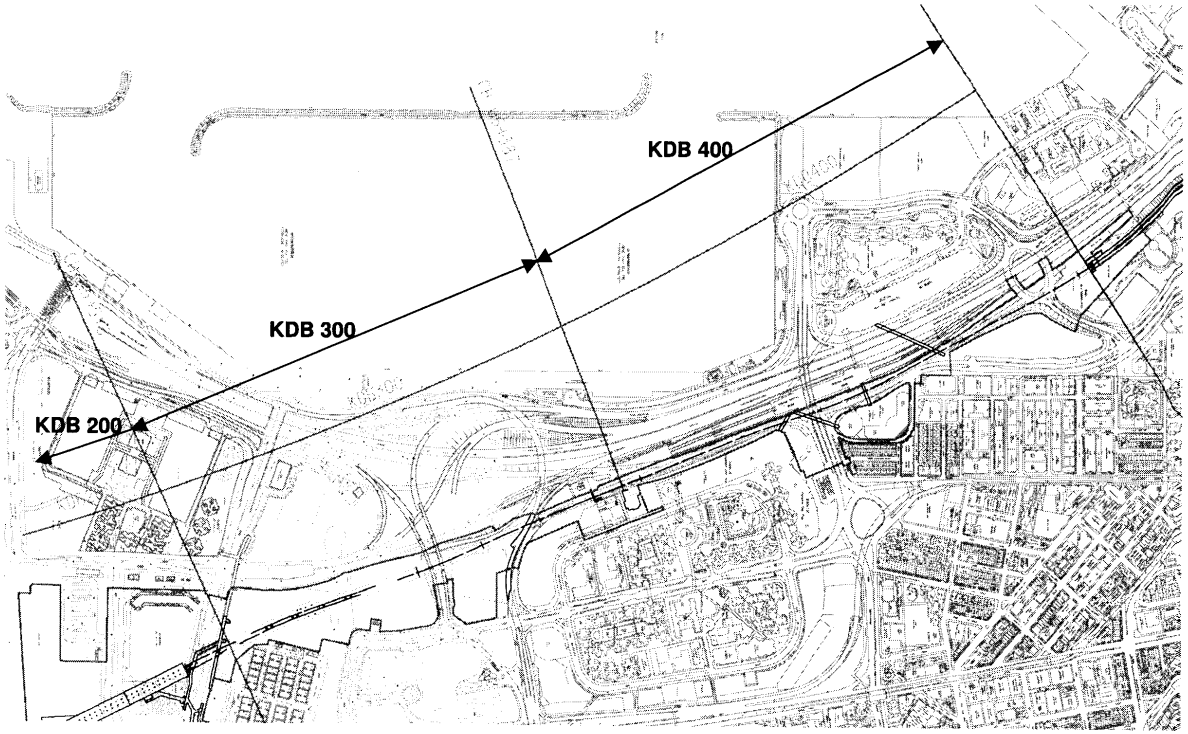


Figure 4-1 Sections of Construction Site of KSL Contracts

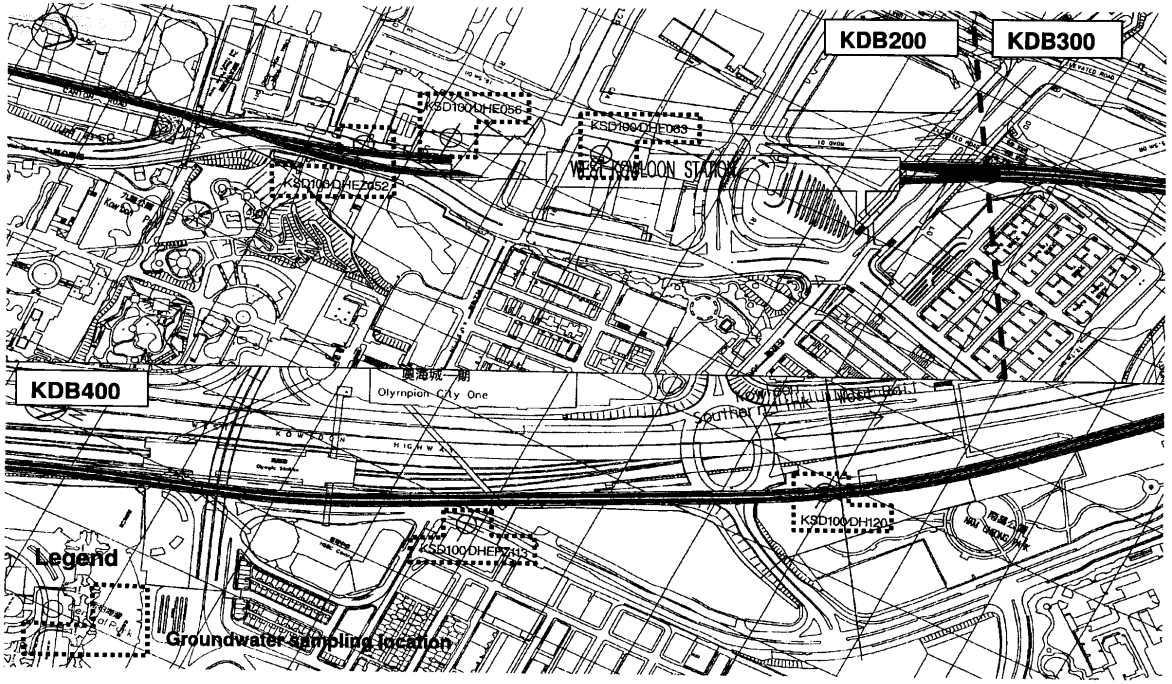


Figure 4-2 Groundwater Sampling Locations in KSL EIA

5 Monitoring Methodology

5.1 Baseline Monitoring

Baseline monitoring should be carried out at all sampling wells identified in Section 4.

Baseline monitoring was carried out from 23 June to 29 June 2006 at the sampling wells, AGM1 to AGM4, AGM6&7, M1 and M2, R1 and R2, and C1. Due to the temporary traffic arrangement, access to AGM5 was not available during the baseline monitoring period. Thus, alternative location, AGM5a, was identified. However, due to the site constraint, AGM5a could only be located outside the excavation area but at the site boundary near the recharge area near Zone F as shown in Annex 1. Monitoring at AGM5a was carried out from 6 July to 12 July 2006.

5.1.1 Sampling Frequency

Groundwater samples from the wells were collected daily for 7 consecutive days in accordance with the KSL EM&A manual.

5.1.2 Testing Parameters

Referred to KSL EIA report, within KDB400 site only the concentration of contaminant of Mercury (Hg) was found exceeded the discharge limit as stipulated in TM at KSD100/DHEPZ113 and TPH was present in the groundwater at KSD100/DHEPZ113 and KSD100/DHE120. KSL report also shows that the concentrations of Cd, Cu, Pb and Zn at KSD100/DHEPZ113 and Cd at KSD100/DHE120 were close to the discharge limits. Therefore groundwater samples were tested for the parameters as listed in Table 5-3. Table 5-3 also shows the reporting limits and analytical methods of the parameters to be tested. All the analytical works, except pH and Temperature, will be carried out by HOKLAS accredited laboratory. All the surplus groundwater generated from the sampling works will be recharged to the same location.

Parameters	Monitoring Well	Analytical Method	Reporting Limit[1] (mg/L)	TM-Water effluent limit[2] for inshore waters of VHWCZ (mg/L)
Groundwater Level	AGM1 to AGM7, R1 to R2, M1 to M3, C1, C2 and C3 (15 wells)	In house	0.1m	–
pH		In house	0.1unit	6-9
Temperature °C		In house	0.1°C	< 40°C
TPH C6 – C9		USEPA8015	20 µg/L	–
TPH C10–C14			25 µg/L	–
TPH C15 – C28			25 µg/L	–
TPH C29 – C36			25 µg/L	–
Cd		USEPA6020	0.0002	0.001
Cu	AGM1 to AGM6, R1, M1, C1, C2 and C3 (11 wells)		0.001	0.1
Pb			0.001	0.1
Zn			0.01	0.1
Hg		APHA3112B	0.0005	0.001
Total Toxic Metals	N/A	N/A	N/A	0.2

Notes:

1. Lowest detection limits could be achieved by common commercial laboratories in Hong Kong. For those substances not detected using these detection limits, it is assumed that such substances do not exist in the water sample.
2. As the maximum dewatering rate is 3,200m³/day, the discharge limits for the flow band of >3,000 and ≤4,000 m³/day are adopted.

Table 5-3 Baseline Groundwater Testing Parameters

5.2 Impact Monitoring

Impact monitoring will be carried out at monitoring well, control well and, where appropriate, inlet of recharge well or outlet of treatment facilities according to Table 4-2 as mentioned in Section 4 during the recharge operation.

5.2.1 Sampling Frequency

Weekly monitoring of groundwater quality at the monitoring well, inlet of recharge wells/outlet of treatment facilities and control wells will be carried out during the recharging operation. Groundwater level at the monitoring wells and control wells will also be monitored on a daily basis.

5.2.2 Testing Parameters

As the baseline monitoring results show that only the concentration of TPH in the groundwater does not comply with discharge limit as stipulated in TM (details are mentioned in Section 6), monitoring parameters will only include groundwater level and TPH during the impact monitoring stage.

The analytical method and detection limit will be the same as mentioned in Table 4-1.

5.3 Sampling Method

5.3.1 Requirements of Monitoring Wells

Following are the general requirements of the groundwater monitoring wells:

- Monitoring wells should be constructed to the depth of at least 3m below groundwater table.
- A well pipe should be placed within a borehole for the formation of well.
- The well pipe should comprise a well casing and a well screen with an inner diameter of 75mm. The materials for well casing and well screen should be inert not reacting with, releasing and adsorbing contaminants.
- The well screen, which is the bottom part of the well pipe, should be formed from the bottom end of the monitoring well to the depth of ground water table. The well screen should be a slotted pipe that allows water flow into the well without allowing the entrance of soil particles into the well causing build up of sediment in the well.
- The well screen should be surrounded by granular material (filter pack) such as gravel in the annular space of the borehole.
- The well casing should be a solid walled pipe that connects the well screen with the ground surface.
- Approximate 1m bentonite seal should be placed around the well casing at the annular space of the borehole above the sampling zone of the well screen to prevent migration of contaminants. Above the bentonite seal, the annular space of the borehole should be grouted with cement, bentonite or water slurry.
- A concrete pad should be constructed at the ground surface around the well casing.
- Sampling cap and bottom cap should be provided at the top and bottom end of the well pipe.
- A concrete security casing with lockable cover should be installed at the ground surface for protecting the monitoring well.
- Following the installation, the well should be developed using pump, bailer or surge block to remove any materials or contaminants that might have entered the well during installation and from filter pack. Development should be continued until the water is visibly clean.
- After development of the monitoring well, sufficient time for equilibrium should be allowed.

Typical installation details of groundwater monitoring well are shown in Annex 5.

5.3.2 Groundwater Sampling

- Prior to any groundwater sampling, purging will be carried out for removing stagnant water. No sample will be collected from the well which is not purged with 24 hours.
- During groundwater purging, at least three volume of groundwater in the well will be purged. The pumping rate for purging will less than the pumping rate in developing the monitoring well.
- The presence of floating product and its thickness will be recorded at each sampling point before and after groundwater purging.
- Samples may be taken by pump or Teflon/stainless steel downhole bailer. Sampling equipment should be decontaminated between sampling locations using distilled water.

5.4 Sample Handling

All the groundwater samples collected should be transferred to clearly labelled and pre-cleaned sample containers with necessary preservatives immediately after collection. The sample containers should be provided by HOKLAS accredited laboratory. Sufficient quantity of samples should be collected for all laboratory analyses. Following sampling, samples should be stored in a cool box at temperature of between 0 and 4 °C, and transported to the laboratory within the sample retention time as advised by the laboratory under proper chain-of-custody system.

6 Baseline Monitoring Results

6.1 Monitoring Results

Table 6-4 summarises average value of the baseline monitoring results at each sampling location throughout the sampling period. Detailed baseline monitoring results are given in Annex 6.

Parameters		Discharge Limit	AGM1	AGM2	AGM3	AGM4	AGM6	AGM7	R1	AGM5a	R2	M1	M2	C1
Temperature	Average	< 40°C	27.2	26.9	26.6	27.4	26.5	26.9	27.2	26.2	26.7	26.5	25.8	26.2
	Range		27.1 – 27.4	26.7 – 27.2	26.4 – 27.1	27.0 – 27.9	26.0 – 27.0	26.4 – 27.5	27.1 – 27.4	26.0 – 26.3	26.3 – 27.0	26.2 – 26.9	25.3 – 26.0	25.4 – 26.7
pH	Average	6-9	7.6	7.4	7.5	7.7	7.5	7.5	7.6	8.1	7.8	7.8	7.5	7.6
	Range		7.6 – 7.8	7.2 – 7.5	7.4 – 7.6	7.6 – 7.8	7.4 – 7.5	7.4 – 7.6	7.6 – 7.8	8.1 – 8.1	7.4 – 8.1	7.5 – 8.2	7.3 – 7.8	7.6 – 7.7
Groundwater Level	Average	-	2.0	2.3	2.5	1.4	2.1	2.4	2.1	2.1	2.8	2.2	5.0	2.4
Mercury	Average	1	0.50	0.50	0.50	0.50	0.50	N/A	0.50	0.50	N/A	0.50	N/A	0.50
	Range		0.5 – 0.5	0.5 – 0.5	0.5 – 0.5	0.5 – 0.5	0.5 – 0.5	N/A	0.5 – 0.5	0.5 – 0.5	N/A	0.5 – 0.5	N/A	0.5 – 0.5
Cadmium	Average	1	0.23	0.27	0.20	0.23	0.21	0.76	0.20	0.20	0.23	0.40	0.43	0.50
	Range		0.2 – 0.3	0.2 – 0.5	0.2 – 0.2	0.2 – 0.3	0.2 – 0.3	0.4 – 1.0	0.2 – 0.2	0.2 – 0.2	0.2 – 0.4	0.2 – 1.0	0.2 – 0.5	0.2 – 1.0
Copper	Average	100	3.3	7.7	2.0	1.3	1.0	N/A	3.4	1.0	N/A	2.7	N/A	2.9
	Range		1 – 7	1 – 20	1 – 4	1 – 2	1 – 1	N/A	2 – 6	1 – 1	N/A	1 – 7	N/A	2 – 5
Lead	Average	100	34.9	42.4	13.4	38.0	7.3	N/A	41.0	5.6	N/A	140.1	N/A	139.1
	Range		11 – 50	14 – 97	4 – 28	8 – 75	4 – 23	N/A	26 – 76	4 – 8	N/A	26 – 420	N/A	28 – 327
Zinc	Average	100	51.0	63.3	13.0	12.7	10.0	N/A	15.7	10.0	N/A	13.4	N/A	24.3
	Range		19 – 116	12 – 156	13 – 164	10 – 27	10 – 10	N/A	10 – 25	10 – 10	N/A	10 – 25	N/A	12 – 39
Total Toxic Metals	Average	200	89.9	114.2	29.1	52.7	19.1	0.76	60.8	17.3	0.23	157.1	0.43	167.3
	Range		34.7 – 163.7	28.7 – 236.7	18.7 – 196.7	19.7 – 104.8	15.7 – 34.8	0.4 – 1.0	42.7 – 107.7	15.7 – 19.7	0.2 – 0.4	37.7 – 453.5	0.2 – 0.5	42.7 – 372.5
TPH C6 – C9	Average	-	20.00	22.86	20.00	20.00	20.00	78.43	76.43	60.57	20.14	133.71	120.00	54.14
	Range		20 – 20	20 – 40	20 – 20	20 – 20	20 – 20	20 – 107	20 – 188	30 – 124	20 – 21	30 – 237	20 – 199	20 – 118
TPH C10–C14	Average	-	36.86	61.29	40.14	33.14	26.57	89.29	197.29	30.57	90.14	53.00	79.57	49.86
	Range		25 – 78	25 – 166	25 – 58	25 – 45	25 – 36	64 – 123	25 – 588	25 – 42	32 – 262	29 – 80	59 – 102	38 – 62
TPH C15 – C28	Average	-	189.86	431.71	313.86	136.71	150.29	264.14	374.86	784.43	285.86	310.43	255.71	409.86
	Range		53 – 342	183 – 971	122 – 448	25 – 235	67 – 210	206 – 301	154 – 797	651 – 913	101 – 552	180 – 533	188 – 318	215 – 580
TPH C29 – C36	Average	-	58.71	136.14	128.14	31.00	26.00	63.00	87.00	30.43	217.43	43.00	39.57	41.00
	Range		25 – 138	40 – 335	52 – 214	25 – 48	25 – 29	48 – 110	25 – 123	25 – 40	32 – 506	25 – 53	26 – 52	35 – 45
TPH (Total)	Average	-	305.4	652.0	502.1	220.9	222.9	494.9	735.6	906.0	613.6	540.1	494.9	554.9
	Range		123 – 547	273 – 1492	219 – 740	95 – 331	137 – 291	346 – 588	224 – 1528	738 – 1009	185 – 1311	300 – 768	302 – 816	351 – 696

Notes:

1. All units are in µg/L except for groundwater level. Groundwater level is in mPD.
2. No groundwater level limit is stipulated in TM.
3. TPH is prohibited substance according to TM.
4. N/A – Testing of the parameters was not carried out. Referring to Section 5.1, the parameters are not of concern at the relevant locations.

Table 6-4 Summary of Baseline Groundwater Monitoring Results

Baseline monitoring results show that the average concentrations of Hg, Cd, Cu, Pb and Zn and average concentrations of total toxic metals at AGM1 to AGM4 and AGM6, and average concentration of Cd at AGM7 comply with discharge limits of the flow band of >3000 and ≦ 4000 m^3/day (i.e. the maximum dewatering rate) as stipulated in the TM.

TPH was found in the groundwater samples from all of the monitoring wells. The average concentrations of TPH were found from the range of 220.9μg/L to 906.5μg/L. The highest average TPH concentration is found at AGM5a where is located within the recharge area near Zone F. AGM5a is outside the tunnel footprint and no water at AGM5a will be dewatered. The average TPH concentrations at R1 and R2 are 735.6μg/L and 613.6μg/L respectively.

It is found that the average TPH concentrations at ambient groundwater monitoring wells, AGM4 and AGM6, are better than that of R1. However, it is found that average TPH (C15-C28 and C29-C36 at AGM2 and C29-C36 at AGM3) concentrations are higher than those of R1. Moreover, average TPH (C6-C9) concentration at AGM7 is higher than that of either R1 or R2.

AGM6 represents groundwater quality at Zone E. Thus, groundwater from Zone E can be recharged to R1 in accordance with the KSL EIA report and EM&A manual.

AGM2 and AGM3 can represent groundwater quality of Zones F and G and AGM7 represents groundwater quality of Zones A, B, C and D. Thus, groundwater from Zones A to D and Zones F to G should be treated prior to recharge in order to avoid affecting the groundwater quality at the recharge area. Details of the requirements of treatment facility are discussed in Section 8.

6.2 Extent of Contamination

The baseline monitoring results show that TPH and heavy metals were found across the site area to the north of the old seawall at KDB400. However, the average concentrations of individual metals and total toxic metals at relevant sampling locations, except for the average concentration of lead at C1, comply with respective discharge limits as stipulated in the TM. As mentioned in Section 4.1, the old seawall would potentially restrict the migration of contaminated groundwater from the petrol filling station at Skyway House to the south of the seawall. Moreover, there was no potential contaminated area identified at the site areas to the south of the seawall at KDB400 in the KSL EIA report. Thus, it is considered that the extent of the contamination of groundwater is from the old seawall to the northern end of KDB400 site.

7 Event and Action Plan

7.1 Limit Level

Limit Levels for the impact monitoring have been developed based on the ambient water quality measurement. Reference is also made to the approach for determining Action and Limit (A/L) Levels in Appendix D2 to the Environmental Monitoring and Audit Guidelines for Development Projects in Hong Kong (EPD, February 1998) and KSL EM&A manual for the inlet of recharge wells/outlet of treatment facilities. The Limit Levels for R1 and R2 of where impact monitoring will be carried out are shown in Table 7-5.

Parameters	Limit Level (95 percentile of baseline data)	
	R1	R2
TPH (C6-C9)	165.5	20.7
TPH (C10-C14)	531.3	227.2
TPH (C15-C28)	711.5	543.9
TPH (C29-C36)	118.8	497.3

Note: Exceedance is considered valid only if there is no justification from the monitoring at the control well.

Table 7-5 Limit Levels of TPH at Recharge Wells/Outlet of Treatment Facilities

Monitoring wells will be used to ensure there is no likelihood of local risen of and transfer of pollutant beyond the site boundary. The limit levels for the groundwater level and TPH at monitoring wells are shown in Table 7-6. In order to monitor the natural variation of groundwater, water level at control well will also be monitored.

Parameters	Limit Level			
	M1	AGM5a (M4)	M2a	M3
Groundwater level	3.2	3.1	6.0	To be Determined
TPH (C6-C9)	284.4	148.8	238.8	To be Determined
TPH (C10-C14)	96	50.4	122.4	To be Determined
TPH (C15-C28)	639.6	1095.6	381.6	To be Determined
TPH (C29-C36)	63.6	48	62.4	To be Determined

Notes:

1. Exceedance is considered valid only if there is no justification from the monitoring at the control well.
2. Limit level for groundwater level is 1m above baseline level.
3. Limit level for TPH is 120% of the maximum concentration of the baseline monitoring. As M2a is close to M2, baseline monitoring results of M2 is considered representative for establishing the limit level of M2a. Otherwise, baseline monitoring at M2a is required to determine the limit level prior to the impact monitoring.

Table 7-6 Limit Levels at Monitoring Wells

7.2 Event and Action Plan

In case of any exceedance of Limit Levels, actions in accordance with the event and action plan as shown in Table 7-7 should be taken.

Event	Action			
	ET Leader	IEC	ER	Contractor
Groundwater level exceeds 1m from baseline Level	• Notify IEC and the Contractor. • Carry out investigation. • Report the results of investigation to IEC and the Contractor. • Discuss with the Contractor and formulate remedial measures. • Increase monitoring frequency to check mitigation measures.	• Review with analysed results submitted by ET. • Review the proposed remedial measures by the Contractor and advise ER accordingly. • Supervise the implement of remedial measures.	• Confirm receipt of notification of exceedance in writing. • Notify the Contractor. • Require the Contractor to propose remedial measures for the analysed groundwater problem. • Ensure remedial measures are properly implemented.	• Reduce the recharge rate AND / OR • Suspend the recharge until the groundwater level falls back to less than 1m difference with the baseline

Event	Action			
	ET Leader	IEC	ER	Contractor
Limit Level Exceedance for TPH	• Notify IEC and the Contractor. • Carry out investigation. • Report the results of investigation to IEC and the Contractor. • Discuss with the Contractor and formulate remedial measures. • Increase monitoring frequency to check mitigation measures.	• Review with analysed results submitted by ET. • Review the proposed remedial measures by the Contractor and advise ER accordingly. • Supervise the implement of remedial measures.	• Confirm receipt of notification of exceedance in writing. • Notify the Contractor. • Require the Contractor to propose remedial measures for the analysed groundwater problem. • Ensure remedial measures are properly implemented.	• Suspended the recharge OR • Treatment of the recharged groundwater until monitoring result shows the compliance of Limit Level

Table 7-7 Event and Action Plan

8 Groundwater Treatment

Based on the baseline monitoring results, recharge areas have been identified for recharging the groundwater. As mentioned in Section 6, groundwater from Zones A to D and E to F is required to be treated prior to recharge. Treatment will also be required for groundwater from Zone E as a contingency in case of exceedance is revealed.

It is considered that treatment process such as chemical enhanced sedimentation, physical filtration and activated carbon filter should be used to remove the suspended solids and organics laden in the groundwater. Groundwater treatment plant with treatment capacity of 40m^3/hr (960 m^3/day) will be provided. Based on the dewatering rates, the numbers of treatment facilities at different time periods are shown in Table 8-8 below:

Period	Estimated Dewatering Rate, m³/day	Number of Treatment Facilities	Recharge Area
16 Oct 06 to 31 Oct 06	960	1	Recharge area at Nam Cheong Park near Zone A
1 Nov 06 to 30 Nov 06	320	1	
1 Dec 06 to 15 Dec 06	1,664	2	
16 Dec 06 to 31 Dec 06	1,920	2	
1 Jan 07 to 15 Jan 07	1,152	2	
16 Jan 07 to 31 Jan 07	2,304	3	
1 Feb 07 to 30 Jun 07	1,536	2	
1 Feb 07 to 15 Feb 07	1,536	2 (Contingency for Zone E only)	Recharge area adjacent the KSL alignment near the construction site of Olympic City Phase III near Zone F
16 Feb 07 to 28 Feb 07	2,240	2 plus 1 for Contingency for Zone E only	
1 March 07 to 15 March 07	3,200	3 plus 1 for Contingency for Zone E only	
15 March 07 to 30 Sep 07	1,792	1 plus 1 for Contingency for Zone E only	

Table 8-8 Number of Treatment Facilities

Each of the treatment plant will include three treatment components: chemical enhanced sedimentation tank, sand filter and activated carbon filter. The schematic process of the groundwater treatment is shown in Figure 8-3. Suspended solids in the contaminated groundwater will be removed by both chemical enhanced sedimentation and sand filter to approximate 5mg/L in order to avoid blockage of activated carbon filter. Activated carbon filter will be designed to treat the TPH to be half of the Limit Levels of the recharges wells.

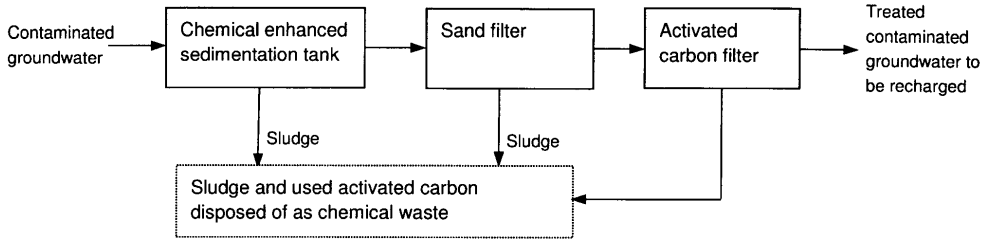


Figure 8-3 Schematic Process of Groundwater Treatment

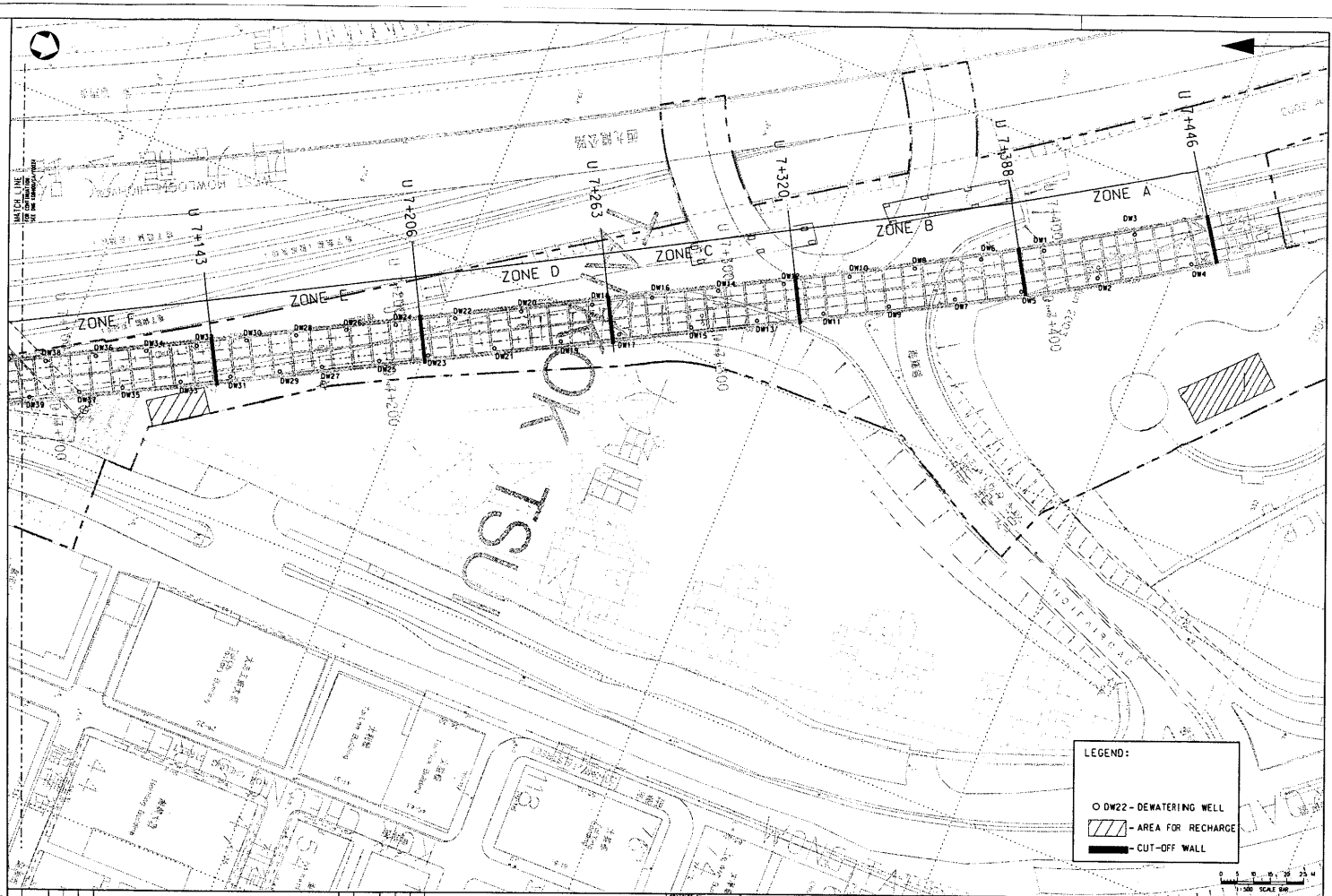
9 Additional Groundwater Monitoring Works

It should be noted that baseline monitoring at C2, C3 and M3 has not been undertaken during the preparation of this working plan. The baseline monitoring results of these locations is for comparing with the impact monitoring results during the impact monitoring stage for evaluating any significant impact of groundwater by the recharge operation. The identified recharge wells and, if necessary, appropriate treatment facilities would not be subject to the baseline monitoring results of C2, C3 and M3. However, baseline monitoring at C2, C3 and M3 should be carried out and monitoring results should be submitted to EPD for record prior to any impact monitoring at these locations (i.e. dewatering works of Zones C to G).

This working plan has been prepared based on the best available information at this stage. Nevertheless, if additional recharge areas (refer to Section 4.2) and evaluation of contamination of groundwater for further excavation areas are required, baseline monitoring at additional sampling wells will be required to determine the suitable recharge well and ascertain the necessity of treatment prior to groundwater recharge. Additional baseline monitoring and formulation of impact monitoring including the Limit Level for impact monitoring would adopt the same approach of this WP.

Annex 1

Locations of Dewatering Areas, Recharge Areas and Monitoring Wells



Maps reproduced with permission of The Director of Lands. (C) Hong Kong Government.

REV	DATE	BY	SUB	APP	DESCRIPTION
A	02AUG06				FIRST ISSUE

DESIGNED BY
DRAWN BY KCCHAN
CHECKED BY
RM
IN CHARGE
AC
DATE 02AUG2006

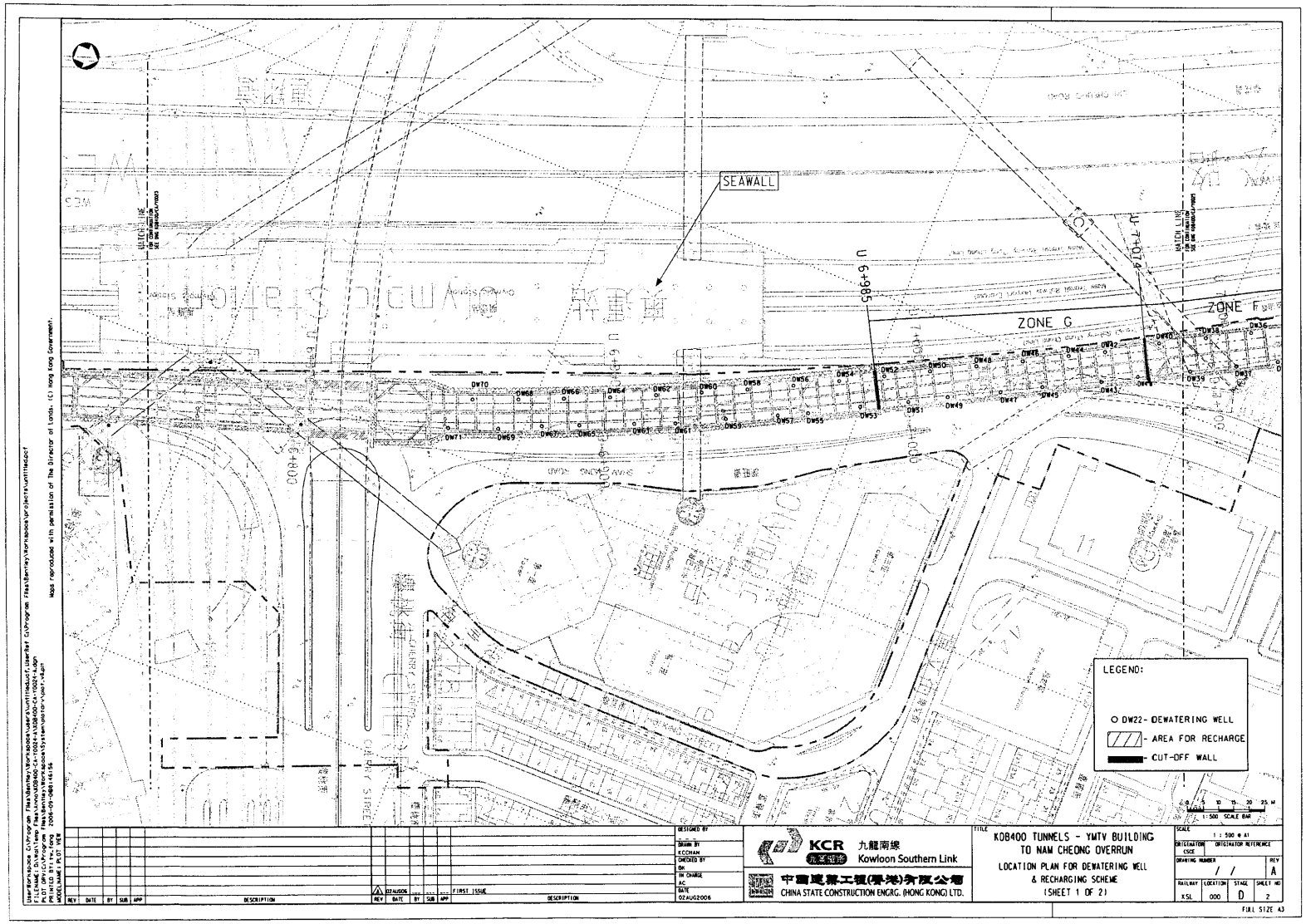
KCR 九廣鐵路 Kowloon Southern Link

中國建築工程(香港)有限公司 CHINA STATE CONSTRUCTION ENGRG. (HONG KONG) LTD.

TITLE
KOB400 TUNNELS - YWTV BUILDING TO NAM CHEONG OVERRUN
LOCATION PLAN FOR DEWATERING & RECHARGING SCHEME (SHEET 2 OF 2)

SCALE 1 : 500 @ A1
ORIGINATOR CSCE
ORIGINATOR REFERENCE
DRAWING NUMBER / /
REV A
RAILWAY KSL | LOCATION 000 | STAGE D | SHEET NO 3

FULL SIZE A3



Maps reproduced with permission of The Director of Lands. (C) Hong Kong Government.

REV	DATE	BY	SUB	APP	DESCRIPTION
A	07AUG06				FIRST ISSUE

DESIGNED BY
DRAWN BY K.C.CHAN
CHECKED BY OK
IN CHARGE AC
DATE 02AUG2006

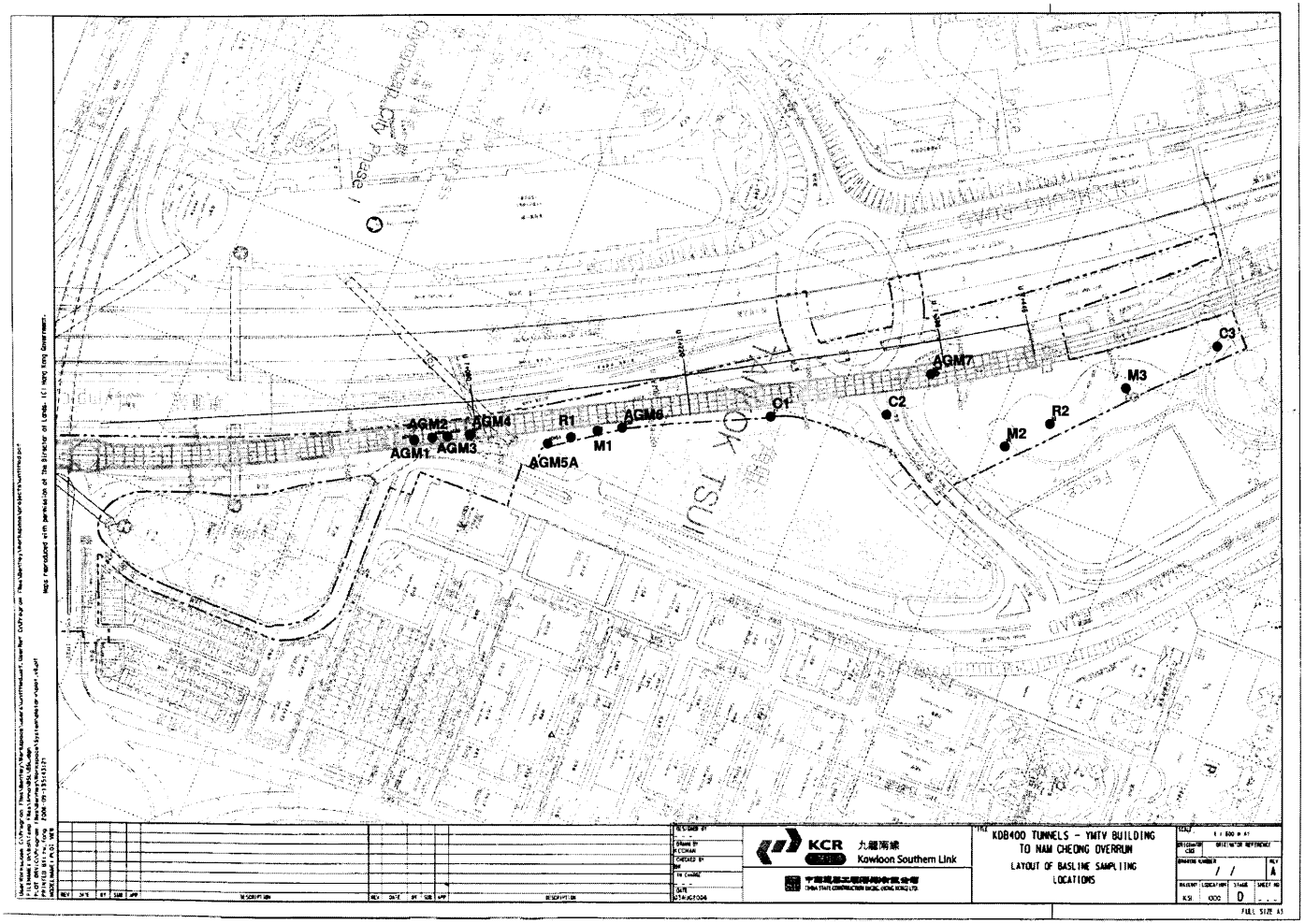
KCR 九龍南線 Kowloon Southern Link

中國建築工程(香港)有限公司
CHINA STATE CONSTRUCTION ENGRG. (HONG KONG) LTD.

TITLE
K08400 TUNNELS - YMTV BUILDING TO NAM CHEONG OVERRUN
LOCATION PLAN FOR DEWATERING WELL & RECHARGING SCHEME (SHEET 1 OF 2)

SCALE 1 : 500 @ A1
ORIGINATOR CSCE
ORIGINATOR REFERENCE
DRAWING NUMBER / /
REV A
RAILWAY KSL
LOCATION 000
STAGE D
SHEET NO 2

FULL SIZE A3


AGM1
AGM2
AGM3
AGM4
AGM5A
AGM6
AGM7
R1
M1
C1
C2
C3
M2
M3
R2
TSUI
KCR
九廣鐵路
Kowloon Southern Link
KDB400 TUNNELS - YMTV BUILDING
TO NAM CHEONG OVERRUN
LAYOUT OF BASLINE SAMPLING
LOCATIONS
FULL SIZE A3

Dewatering Schedule for Areas with Groundwater having detectable TPHs

Dewatering Zone	Chainage	Dewatering Wells Nos.	No. of DW	Daily averaged hourly dewatering rate per DW (m3/hr)	Estimated Total Daily Zone Dewatering Rate (m3/day) for the Dewatering Phase [see note]	
					Total water-table drawdown & Pumping Test	Seepage Control
A	7+446 to 7+388	DW1 - DW4	4	10	960	320
B	7+388 to 7+320	DW5 - DW11	7	8	1,344	448
C	7+320 to 7+263	DW12 - DW17	6	8	1,152	384
D	7+263 to 7+206	DW18 - DW23	6	8	1,152	384
E	7+206 to 7+143	DW24 - DW31	8	8	1,536	512
F	7+143 to 7+074	DW32 - DW40	9	8	1,728	576
G	7+074 to 6+985	DW41 - DW50 & DW52	11	8	2,112	704

Note :

1 Actual dewatering rates shall be verified upon obtaining the local soil permeability value from the pumping test

2 The pumping test shall be conducted prior to commencing the dewatering operation

Tentative Programme for Dewatering of Contaminated Groundwater

中國建築工程(香港)有限公司
CHINA STATE CONSTRUCTION ENGRG. (HONG KONG) LTD.

Contract No. & Name	KDB400 Tunnels - Yau Ma Tei Vent. Bldg. to Nam Cheong Overrun

Date : 25 August 2006

Major Construction Works	2006					2007											
	A	S	O	N	D	J	F	M	A	M	J	J	A	S	O	N	D
Zone A Chainage U7+446 to U7+388 (Nam Cheong Park)																	
Recharge wells installation																	
Pumping test & Full Draw-down of Water Table																	
Seepage Control during Excavation and Tunnel Construction																	
Backfilling																	
Zone B Chainage U7+388 to U7+320 (Prince Edward Roundabout)																	
Recharge wells installation																	
Pumping test & Full Draw-down of Water Table																	
Seepage Control during Excavation and Tunnel Construction																	
Backfilling																	
Zone C Chainage U7+320 to U7+263 (Prince Edward Roundabout)																	
Recharge wells installation																	
Pumping test & Full Draw-down of Water Table																	
Seepage Control during Excavation and Tunnel Construction																	
Backfilling																	
Zone D Chainage U7+263 to U7+206 (Olympian City III)																	
Recharge wells installation																	
Pumping test & Full Draw-down of Water Table																	
Seepage Control during Excavation and Tunnel Construction																	
Backfilling																	
Zone E Chainage U7+206 to U7+143 (Olympian City III)																	
Recharge wells installation																	
Pumping test & Full Draw-down of Water Table																	
Seepage Control during Excavation and Tunnel Construction																	
Backfilling																	
Zone F Chainage U7+143 to U7+074 (OC III - Circulation Tower)																	
Recharge wells installation																	
Pumping test & Full Draw-down of Water Table																	
Seepage Control during Excavation and Tunnel Construction																	
Backfilling																	
Zone G Chainage U7+074 to U6+990 (Pok Man Street)																	
Recharge wells installation																	
Pumping test & Full Draw-down of Water Table																	
Seepage Control during Excavation and Tunnel Construction																	
Backfilling																	

Annex 2

Analytical Results of Five Sampling Location in EIA Stage

Government Office, Tai Kok Tsui petrol filling station at Skyway House and the factory building at Shum Mong Road.

Site investigations were conducted between Oct 2002 and Feb 2003. Ground water table was found at about 1-2m below the ground level. The locations of the collected groundwater samples are shown in **Figure 8-2.** Some of the water samples show certain degree of contamination as described in the following sections.

(a) Groundwater Analytical Results

Table 8-3 shows the measurement results for the groundwater samples taken from 5 drillholes. Heavy metals (including Cd, Cr, Cu, Ni, Pb, Zn, Hg, As, Ba, Co, Mo and Sn), BTEX, cyanide, PAH, Total Petroleum Hydrocarbon (TPH) and dioxin were tested.

Estimation indicates that the amount of groundwater generated during dewatering will be around 580m^3 per day, which is corresponding to the flow band of 400 – 600m^3 / day listed in the TM-Water.

Table 8-3 : Comparison between contaminants and TM-Water effluent discharge criteria

Parameters	Maximum Concentration[1] (mg/L) (unless specified)					TM-Water Effluent limit for inshore waters of VHWCZ (mg/L)	Reporting Limit (µg/L)[5]
	KSD100/ DHE063	KSD100/D HEPZ052	KSD100/D HEPZ113	KSD100/D HE053	KSD100/ DHE120[9]	400 – 600 m^3 / day	
PH	7.89	8	7.4	7.2	7.7	6-9	
Temperature °C	22.4	20.4	19.1	19.8	26.9	< 40°C	20 –25
TPH C6 – C9	<0.020	<0.020	<0.020	<0.020	<0.020	---	
TPH C10–C14	<0.050	<0.050	<0.050	<0.050	<0.050	---	
TPH C15 – C28	0.115	<0.1	0.13	<0.1	0.11	---	
TPH C29 – C36	<0.050	<0.050	<0.050	<0.050	0.321	---	
Dioxin (pg/L)	0.04	---	---	---	0.019	---	10 pgL
Cd	< 0.0002	**0.0013**	0.0005	<0.0002	0.0005	0.001	
Cr	0.006	0.043	0.051	0.0071	0.0043	0.7	
Cu	0.4	0.230	0.330	0.340	0.055	0.7	
Ni	0.0035	0.023	0.027	0.0057	0.0081	0.7	
Pb	0.013	0.210	0.210	0.0051	0.061	0.7	
Zn	0.130	0.270	0.29	0.053	0.037	0.7	
Hg	< 0.0005	0.0016	**0.0029**	**0.0025**	<0.0005	0.001	
As	<0.010	0.021	0.015	<0.010	<0.010	0.7	
Ba	0.130	0.35	0.35	0.110	0.120	2.7	
Co	0.0045	0.016	0.017	0.0048	<0.001	---	
Mo	0.015	0.019	0.017	0.026	0.0079	---	
Sn	0.0053	0.124	0.074	0.0074	0.011	---	
Total Cyanide (µg/L)	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05	---	
PAH[8] (µg/L)	< 0.5	< 0.5	< 0.5	< 0.5	< 0.5	---	0.1 – 1 (Low molecular weight) 0.02 – 0.1 (High molecular weight)

Parameters	Maximum Concentration[1] (mg/L) (unless specified)					TM-Water Effluent limit for inshore waters of VHWCZ (mg/L)	Reporting Limit (µg/L)[5]
	KSD100/ DHE063	KSD100/D HEPZ052	KSD100/D HEPZ113	KSD100/D HE053	KSD100/ DHE120[3]	400 – 600 m³ / day	
Benzene (µg/L)	< 2	< 2	< 2	< 2	< 2	---	1
Ethylbenzene (µg/L)	< 2	< 2	< 2	< 2	< 2	---	
Toluene (µg/L)	< 2	< 2	< 2	< 2	< 2	---	
Meta- & Para Xylene (µg/L)	< 4	< 4	< 4	< 4	< 4	---	
Ortho Xylene (µg/L)	< 2	< 2	< 2	< 2	< 2	---	

Note [1]: Bolded letters indicate exceedance in discharge limits at flow band of 400 –600m³ /day.
[2]: KSD100/DHEPZ052: Fire Station in Canton Road;
KSD100/DHE053: West Kowloon Reclamation (replaced adjacent drillhole KSD100/DHE056);
KSD100/DHEPZ113: Petrol station in Skyway House;
KSD100/DHE120: Former shipyard site in West Kowloon Reclamation Area;
KSD100/DHE063: industrial activities west Canton Road
[3]: There will be no groundwater discharge from DHE120 as there will only be at-grade rail works
[4]: ProPECC Note 3/94: Contaminated Land Assessment and Remediation
[5]: According to TM-Water, the chemicals concentration for TPH, dioxin, BTEX and PAH should be below the Reporting limit. Discharges of PCB, PAHs, petroleum oil, pesticide and toxicant into foul sewers, inland waters and coastal waters are prohibited. As the presence of these chemicals is not known at this stage, the groundwater cannot be discharged to the stormwater or foul sewer directly.

It can be seen from the above table that the maximum temperature of the samples are less than 40°C and the pH of the samples are in the range of 6-9, which comply with the standards stipulated in TM-Water. In addition, the concentration of Cr, Ni, As, Cu, Pb, Zn, and Ba are well below the TM-Water limits. However, exceedances in heavy metals (Cd and Hg) contents are observed at locations KSD100 / DHEPZ052 (Fire Station in Canton Road), KSD100 / DHE053 (West Kowloon Reclamation), and KSD100/DHEPZ113 (Petrol station in Skyhouse).

(b) Impact on health of construction workers

The Dutch ABC Values for groundwater are based on the use of groundwater for potable supply. As this is rarely the case in Hong Kong, the Dutch B Values are not necessarily appropriate for assessing the requirement of groundwater remediation, particularly within urban areas where there may be numerous diffuse sources of historical contamination within the vicinity. Hence, the Dutch C values are used for assessment.

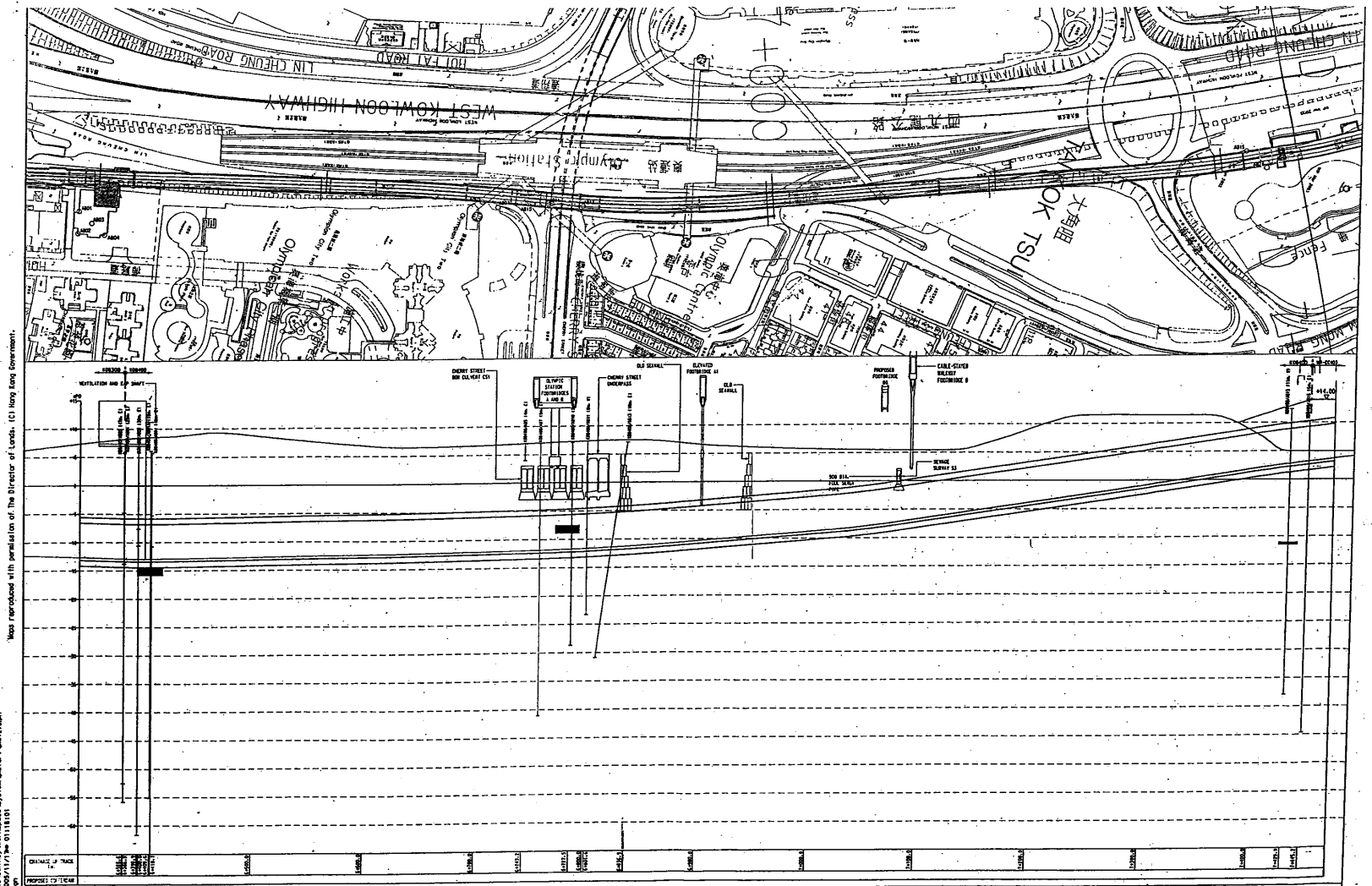
When comparing the groundwater with the Dutch levels, 4 groundwater samples exceed the Dutch C Levels. The analytical results exceeding the Dutch C Levels are given in Table 8-4.

Table 8-4 : Summary of groundwater samples exceeding Dutch C Level

Drillhole reference	Depth (mbgl)	Contaminant	Concentration (µg/L)	Dutch C Limit (µg/L)
KSD100/DHEPZ052	8.0m	Copper	230	200
		Lead	210	200
KSD100/DHE053[1]	6.5m	Copper	340	200
		Mercury	2.5	2
KSD100/DHE063	3.0m	Copper	400	200

Annex 3

Information of Old Seawall



DESIGNED BY					
DRAWN BY					
CHECKED BY					
IN CHARGE					
DATE					
16NOV2005					

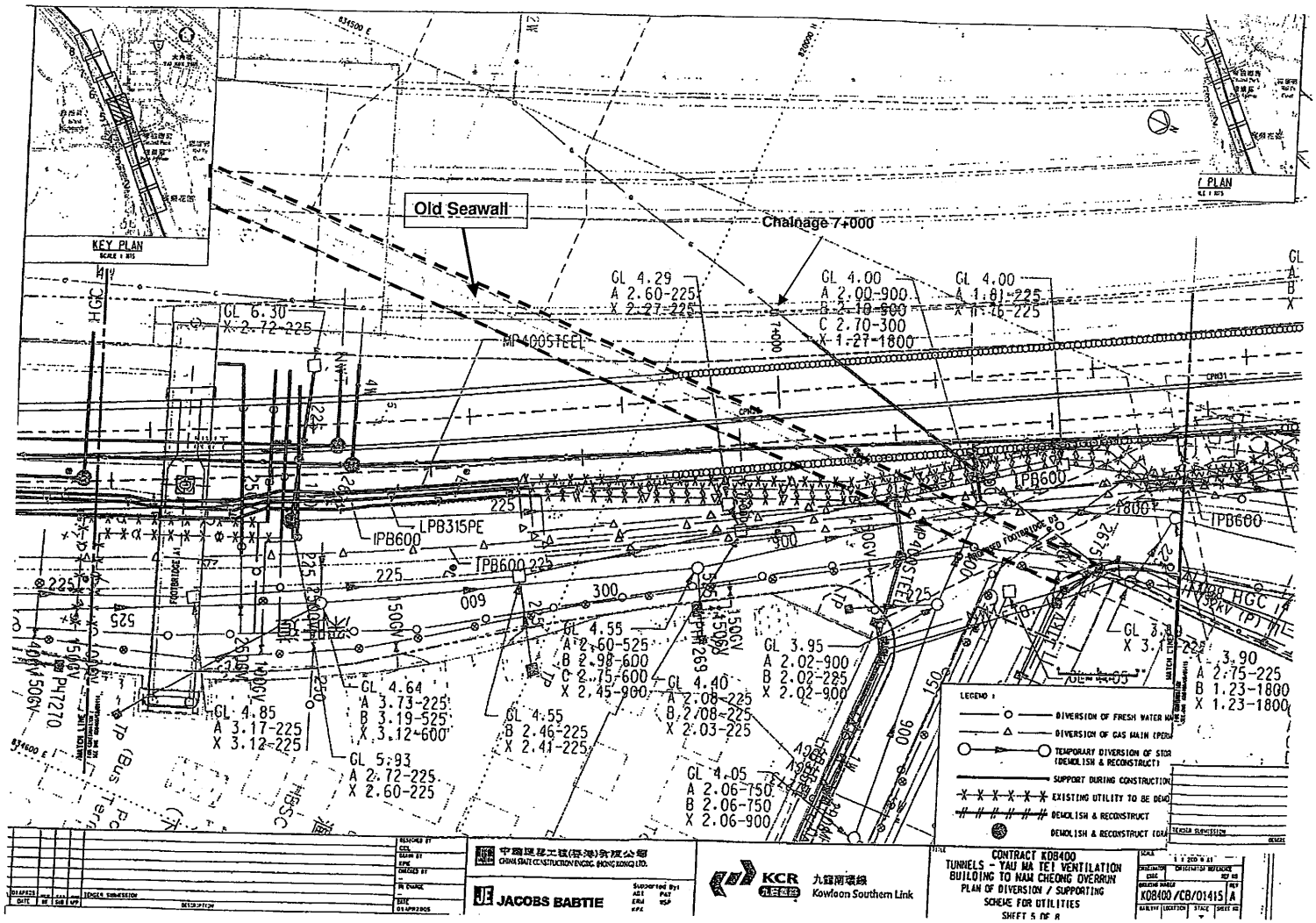
KCR 九龍南線 Kowloon Southern Link

中國建築工程(香港)有限公司 CHINA STATE CONSTRUCTION ENGRG. (HONG KONG) LTD.

TITLE: KDB400 TUNNELS - YMTV BUILDING TO NAM CHEONG OVERRUN

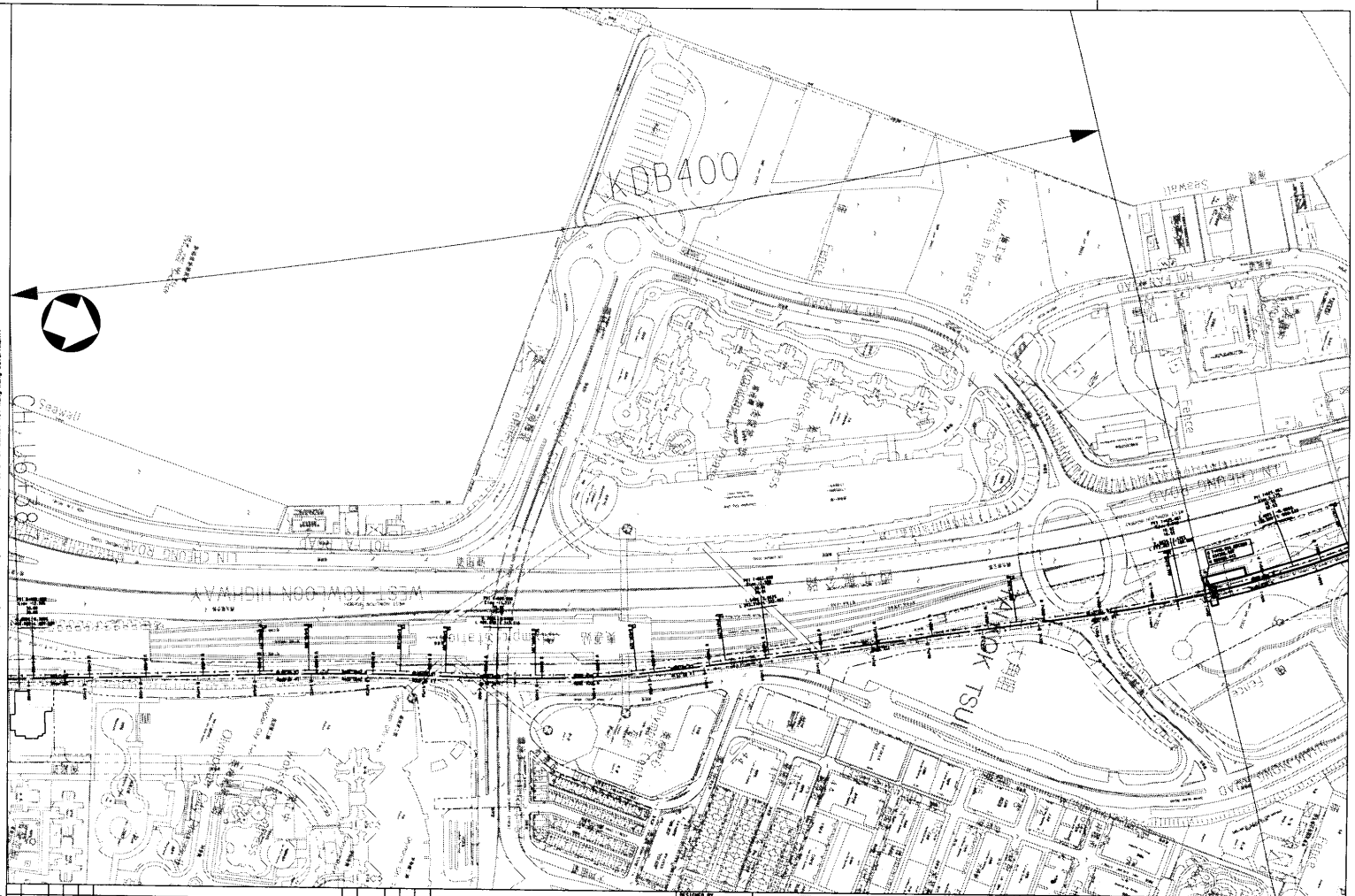
SCALE	1 : 1500		
ORIGINATOR CODE	ORIGINATOR REFERENCE		REF NO
DRAWING NUMBER	/ /		REV A
RAILWAY	LOCATION	STAGE	SHEET NO
---	---	P	---

REV	DATE	BY	SUB	APP	DESCRIPTION


Old Seawall
Chainage 7+000
KEY PLAN
H.G.C.
MP1005TEEL
LPB315PE
IPB600
IPB600 225
GL 6.30
X 2.72-225
GL 4.29
A 2.60-225
X 2.27-225
GL 4.00
A 2.00-900
B 2.10-900
C 2.70-300
X 1.27-1800
GL 4.00
A 1.81-225
X 1.76-225
GL 4.85
A 3.17-225
X 3.12-225
GL 4.64
A 3.73-225
B 3.19-525
X 3.12-600
GL 5.93
A 2.72-225
X 2.60-225
GL 4.55
A 2.60-525
B 2.98-600
C 2.75-600
X 2.45-900
GL 4.55
B 2.46-225
X 2.41-225
GL 4.40
A 2.08-225
B 2.08-225
X 2.03-225
GL 4.05
A 2.06-750
B 2.06-750
X 2.06-900
GL 3.95
A 2.02-900
B 2.02-225
X 2.02-900
GL 3.90
A 2.75-225
B 1.23-1800
X 1.23-1800
LEGEND :
DIVERSION OF FRESH WATER MAIN
DIVERSION OF GAS MAIN (PE
TEMPORARY DIVERSION OF STOR (DEMOLISH & RECONSTRUCT)
SUPPORT DURING CONSTRUCTION
EXISTING UTILITY TO BE DEMO
DEMOLISH & RECONSTRUCT
DEMOLISH & RECONSTRUCT (TRA
CONTRACT KD8400
TUNNELS - YAU MA TEI VENTILATION BUILDING TO NAM CHEONG OVERRUN
PLAN OF DIVERSION / SUPPORTING SCHEME FOR UTILITIES
SHEET 5 OF 8
KD8400 /CB/01415
中國建築工程(香港)有限公司
CHINA STATE CONSTRUCTION ENGRG. (HONG KONG) LTD.
JACOBS BABTIE
KCR 九鐵南環線 Kowloon Southern Link

Annex 4

Site Layout for KDB400



REV	DATE	BY	SUB	APP	DESCRIPTION

REV	DATE	BY	SUB	APP	DESCRIPTION

DESIGNED BY
DK
DRAWN BY
Wai
CHECKED BY
DK
IN CHARGE
HY
DATE
30Aug2005

KCR 九龍南線 Kowloon Southern Link

中國建築工程(香港)有限公司
CHINA STATE CONSTRUCTION ENGRG. (HONG KONG) LTD.

TITLE
KDB300 & 400 TUNNEL
JORDAN ROAD TO NAM CHEONG OVERRUN
Site layout for
KDB400

SCALE 1 : 1500 @ A1

ORIGINATOR	ORIGINATOR REFERENCE
CSHK	KDB400-HA-Y00001A.dgn

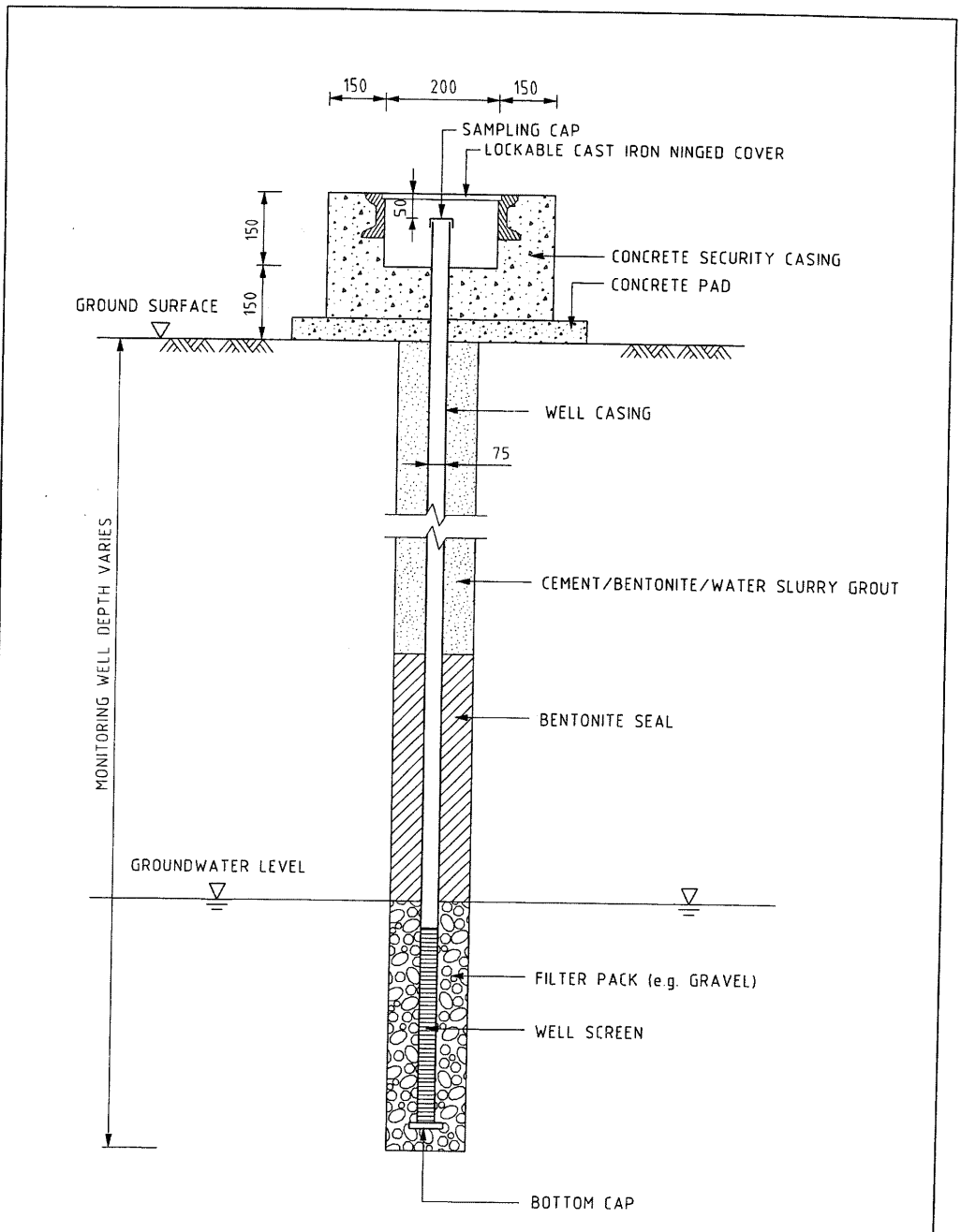
DRAWING NUMBER: KDB400 /HA/Y0001 REV: A

RAILWAY	LOCATION	STAGE	SHEET NO
KSL	---	D	1

FULL SIZE A1

Annex 5

Typical Installation Details of Groundwater Monitoring Wells



ALL DIMENSIONS ARE IN mm

PROJECT TITLE

KCRC KOWLOON SOUTHERN LINK (KSL) - KDB 300x400

CONSULTANT: Hyder Consulting

CLIENT

DRAWING TITLE

TYPICAL INSTALLATION DETAILS OF GROUNDWATER MONITORING WELL

DRG NO: Figure 4-4

REV: -

PRINTED BY ihnk863 2006-5-10 9:45:26 FILENAME K:\EA01273 KSL KDB300&400 Env Team\ES-EA01273 KSL KDB300&400 Env Team\Cad\Issue\1273-Fig-4 4.dgn

Annex 6

Baseline Monitoring Results

Kowloon Southern Link - KDB300 and KDB400 Tunnels, Jordan Road to Nam Cheong Station Overrun
Baseline Monitoring Results

AGM1

Parameter	Unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	27.2	27.2	27.4	27.4	27.1	27.1	27.1	27.2
pH	pH	0.1	7.7	7.8	7.6	7.6	7.6	7.6	7.6	7.6
Groundwater level	mPD	0.1	2.0	2.0	2.0	2.0	2.0	2.0	2.0	2.0
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Cadmium (Dissolved)	µg/L	0.2	<0.2	<0.2	0.3	<0.2	<0.2	<0.2	<0.2	0.21
Cadmium (Total)	µg/L	0.2	<0.2	<0.2	0.3	0.3	<0.2	<0.2	<0.2	0.23
Copper (Dissolved)	µg/L	1	1	1	1	<1	3	3	2	1.71
Copper (Total)	µg/L	1	2	1	2	2	6	7	3	3.29
Lead (Dissolved)	µg/L	1	6	17	27	18	2	2	4	10.86
Lead (Total)	µg/L	1	33	28	45	50	37	40	11	34.86
Zinc (Dissolved)	µg/L	10	26	19	24	26	32	29	12	24.00
Zinc (Total)	µg/L	10	35	19	32	35	100	116	20	51.00
C6 - C9 Fraction	µg/L	20	<20	<20	<20	<20	<20	<20	<20	20.00
C10 - C14 Fraction	µg/L	25	47	<25	<25	<25	33	78	<25	36.86
C15 - C28 Fraction	µg/L	25	342	88	53	95	263	304	184.00	189.86
C29 - C36 Fraction	µg/L	25	138	<25	<25	27	61	87	48.00	58.71
TPH (Total)	µg/L	95	547	158	123	167	377	489	277	305.43

AGM2

Parameter	Unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	27	26.9	27.2	27	26.8	26.7	26.8	26.9
pH	pH	0.1	7.2	7.2	7.4	7.4	7.5	7.5	7.5	7.4
Groundwater level	mPD	0.1	2.3	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Cadmium (Dissolved)	µg/L	0.2	0.3	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	0.21
Cadmium (Total)	µg/L	0.2	0.5	0.4	0.2	<0.2	<0.2	0.2	<0.2	0.27
Copper (Dissolved)	µg/L	1	3	2	1	<1	10	10	3	4.29
Copper (Total)	µg/L	1	5	3	2	<1	19	20	4	7.71
Lead (Dissolved)	µg/L	1	12	17	2	1	1	1	2	5.14
Lead (Total)	µg/L	1	97	40	27	15	42	62	14	42.43
Zinc (Dissolved)	µg/L	10	20	19	10	<10	25	27	11	17.43
Zinc (Total)	µg/L	10	50	22	19	12	156	154	30	63.29
C6 - C9 Fraction	µg/L	20	<20	<20	<20	40	<20	<20	<20	22.86
C10 - C14 Fraction	µg/L	25	50	45	<25	26	88	166	29.00	61.29
C15 - C28 Fraction	µg/L	25	359	309	183	194	705	971	301.00	431.71
C29 - C36 Fraction	µg/L	25	143	74	45	40	208	335	108.00	136.14
TPH (Total)	µg/L	95	572	448	273	300	1021	1492	458	652.00

AGM3

Parameter	Unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	26.4	26.5	26.9	27.1	26.5	26.4	26.6	26.6
pH	pH	0.1	7.5	7.5	7.4	7.4	7.5	7.6	7.5	7.5
Groundwater level	mPD	0.1	2.5	2.5	2.5	2.5	2.5	2.5	2.5	2.5
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Cadmium (Dissolved)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.20
Cadmium (Total)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	0.20
Copper (Dissolved)	µg/L	1	<1	<1	<1	<1	<1	<1	<1	1.00
Copper (Total)	µg/L	1	4	<1	1	<1	2	2	3	2.00
Lead (Dissolved)	µg/L	1	<1	<1	<1	<1	<1	<1	3	1.29
Lead (Total)	µg/L	1	28	4	8	4	16	18	16	13.43
Zinc (Dissolved)	µg/L	10	<10	<10	<10	<10	<10	20	<10	11.43
Zinc (Total)	µg/L	10	164	13	36	27	41	32	34	13.00
C6 - C9 Fraction	µg/L	20	<20	<20	<20	<20	<20	<20	<20	20.00
C10 - C14 Fraction	µg/L	25	46	43	<25	31	42	58	36.00	40.14
C15 - C28 Fraction	µg/L	25	443	208	122	208	351	448	417.00	313.86
C29 - C36 Fraction	µg/L	95	171	52	52	75	148	214	185.00	128.14
TPH (Total)	µg/L	95	680	323	219	334	561	740	658	502.14

AGM4

Parameter	Unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	27.6	27.7	27.6	27.9	27.3	27	27	27.4
pH	pH	0.1	7.8	7.8	7.8	7.7	7.7	7.7	7.6	7.7
Groundwater level	mPD	0.1	1.4	1.4	1.4	1.4	1.4	1.4	1.4	1.4
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.50
Cadmium (Dissolved)	µg/L	0.2	0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	0.20
Cadmium (Total)	µg/L	0.2	0.3	0.3	0.2	<0.2	<0.2	<0.2	<0.2	0.23
Copper (Dissolved)	µg/L	1	<1	<1	<1	<1	<1	1	<1	1.00
Copper (Total)	µg/L	1	2	1	1	<1	<1	<1	2	1.29
Lead (Dissolved)	µg/L	1	26	42	26	18	2	3	4	17.29
Lead (Total)	µg/L	1	75	70	56	30	8	13	14	38.00
Zinc (Dissolved)	µg/L	10	22	10	<10	<10	<10	<10	<10	11.71
Zinc (Total)	µg/L	10	27	10	12	<10	<10	<10	10	12.71
C6 - C9 Fraction	µg/L	20	<20	<20	<20	<20	<20	<20	<20	20.00
C10 - C14 Fraction	µg/L	25	30	35	<25	33	32	45	32.00	33.14
C15 - C28 Fraction	µg/L	25	108	91	<25	122	188	235	188.00	136.71
C29 - C36 Fraction	µg/L	25	37	<25	<25	26	<25	31	48.00	31.00
TPH (Total)	µg/L	95	195	171	95	201	265	331	288	220.86

Kowloon Southern Link - KDB300 and KDB400 Tunnels, Jordan Road to Nam Cheong Station Overrun
Baseline Monitoring Results

AGM5a

parameter	unit	R.L	06-Jul-06	07-Jul-06	08-Jul-06	09-Jul-06	10-Jul-06	11-Jul-06	12-Jul-06	Average
Temperture	Degree	0.1	26	26	26.3	26.2	26.2	26.3	26.3	**26.2**
pH	pH	0.1	8.12	8.12	8.12	8.12	8.12	8.12	8.12	**8.1**
Groundwater level	mPD	0.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	**2.1**
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Cadmium (Dissolved)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.20**
Cadmium (Total)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.20**
Copper (Dissolved)	µg/L	1	<1	<1	1	1	1	<1	<1	**1.00**
Copper (Total)	µg/L	1	1	1	1	1	<1	1	<1	**1.00**
Lead (Dissolved)	µg/L	1	2	<1	<1	<1	<1	<1	<1	**1.14**
Lead (Total)	µg/L	1	8	7	5	5	4	5	5	**5.57**
Zinc (Dissolved)	µg/L	10	<10	<10	<10	<10	<10	<10	<10	**10.00**
Zinc (Total)	µg/L	10	<10	<10	<10	<10	<10	<10	<10	**10.00**
C6 - C9 Fraction	µg/L	20	124	114	37	41	43	30	35.00	**60.57**
C10 - C14 Fraction	µg/L	25	38	42	<25	26	26	29	28.00	**30.57**
C15 - C28 Fraction	µg/L	25	720	791	651	773	913	803	840.00	**784.43**
C29 - C36 Fraction	µg/L	25	40	40	<25	<25	27	27	29.00	**30.43**
TPH (Total)	µg/L	95	922	987	738	865	1009	889	932	**906.00**

AGM6

parameter	unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	26.4	26.6	27	26.9	26.2	26	26.1	**26.5**
pH	pH	0.1	7.5	7.5	7.4	7.5	7.5	7.5	7.4	**7.5**
Groundwater level	mPD	0.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	**2.1**
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Cadmium (Dissolved)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.20**
Cadmium (Total)	µg/L	0.2	0.3	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.21**
Copper (Dissolved)	µg/L	1	<1	<1	<1	<1	<1	<1	<1	**1.00**
Copper (Total)	µg/L	1	<1	<1	<1	<1	<1	<1	<1	**1.00**
Lead (Dissolved)	µg/L	1	4	<1	<1	<1	<1	<1	<1	**1.43**
Lead (Total)	µg/L	1	23	6	4	4	4	4	6	**7.29**
Zinc (Dissolved)	µg/L	10	<10	<10	<10	<10	<10	<10	<10	**10.00**
Zinc (Total)	µg/L	10	<10	<10	<10	<10	<10	<10	<10	**10.00**
C6 - C9 Fraction	µg/L	20	<20	<20	<20	<20	<20	<20	<20	**20.00**
C10 - C14 Fraction	µg/L	25	36	<25	<25	<25	<25	25	<25	**26.57**
C15 - C28 Fraction	µg/L	25	210	158	67	112	166	178	161.00	**150.29**
C29 - C36 Fraction	µg/L	25	25	29	<25	<25	25	<25	28.00	**26.00**
TPH (Total)	µg/L	95	291	232	137	182	236	248	234	**222.86**

AGM7

parameter	unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	26.8	26.7	27.5	27.4	26.9	26.8	26.4	**26.9**
pH	pH	0.1	7.5	7.5	7.6	7.6	7.5	7.4	7.4	**7.5**
Groundwater level	mPD	0.1	2.4	2.4	2.4	2.4	2.4	2.4	2.4	**2.4**
Cadmium(Dissolved)	µg/L	0.2	0.8	<0.2	0.8	0.6	0.6	0.6	<0.2	**0.54**
Cadmium(Total)	µg/L	0.2	1	0.9	0.8	0.8	0.8	0.6	0.4	**0.76**
C6 - C9 Fraction	µg/L	20	107	72	<20	102	93	91	64	**78.43**
C10 - C14 Fraction	µg/L	25	78	89	64	123	94	103	74	**89.29**
C15 - C28 Fraction	µg/L	25	290	230	206	301	299	259	264	**264.14**
C29 - C36 Fraction	µg/L	25	48	59	56	82	52	54	110	**63.00**
TPH (Total)	µg/L	95	523	450	346	588	538	507	512	**494.86**

R1

parameter	unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	27.2	27.2	27.4	27.4	27.1	27.1	27.1	**27.2**
pH	pH	0.1	7.7	7.8	7.6	7.6	7.6	7.6	7.6	**7.6**
Groundwater level	mPD	0.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1	**2.1**
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Cadmium (Dissolved)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.20**
Cadmium (Total)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.20**
Copper (Dissolved)	µg/L	1	<1	<1	<1	<1	<1	<1	<1	**1.00**
Copper (Total)	µg/L	1	6	3	3	3	3	2	4	**3.43**
Lead (Dissolved)	µg/L	1	1	2	2	2	3	<1	<1	**1.71**
Lead (Total)	µg/L	1	76	49	33	27	45	31	26	**41.00**
Zinc (Dissolved)	µg/L	10	<10	<10	<10	<10	<10	<10	<10	**10.00**
Zinc (Total)	µg/L	10	25	<10	12	12	17	14	20	**15.71**
C6 - C9 Fraction	µg/L	20	113	97	28	188	55	34	<20	**76.43**
C10 - C14 Fraction	µg/L	25	84	137	90	58	399	588	<25	**197.29**
C15 - C28 Fraction	µg/L	25	283	291	225	362	512	797	154.00	**374.86**
C29 - C36 Fraction	µg/L	25	84	88	92	88	123	109	<25	**87.00**
TPH (Total)	µg/L	95	564	613	435	696	1089	1528	224	**735.57**

Kowloon Southern Link - KDB300 and KDB400 Tunnels, Jordan Road to Nam Cheong Station Overrun
Baseline Monitoring Results

R2

parameter	unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	26.8	27	27	26.8	26.5	26.3	26.5	**26.7**
pH	pH	0.1	7.4	7.5	7.8	7.8	8.1	8.1	8.1	**7.8**
Groundwater level	mPD	0.1	2.8	2.8	2.8	2.8	2.8	2.8	2.8	**2.8**
Cadmium(Dissolved)	µg/L	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	**0.20**
Cadmium(Total)	µg/L	0.2	0.4	0.2	<0.2	<0.2	<0.2	0.2	<0.2	**0.23**
C6 - C9 Fraction	µg/L	20	<20	21	<20	<20	<20	<20	<20	**20.14**
C10 - C14 Fraction	µg/L	25	54	57	32	32	146	262	48	**90.14**
C15 - C28 Fraction	µg/L	25	214	153	103	101	525	552	353	**285.86**
C29 - C36 Fraction	µg/L	25	60	51	38	32	506	477	358	**217.43**
TPH (Total)	µg/L	95	348	282	193	185	1197	1311	779	**613.57**

M1

parameter	unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	26.5	26.6	26.9	26.9	26.4	26.3	26.2	**26.5**
pH	pH	0.1	8.1	8.2	7.8	7.9	7.7	7.6	7.5	**7.8**
Groundwater level	mPD	0.1	2.2	2.2	2.2	2.2	2.2	2.2	2.2	**2.2**
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Cadmium (Dissolved)	µg/L	0.2	0.2	<0.2	0.2	<0.2	<0.2	<0.2	<0.2	**0.20**
Cadmium (Total)	µg/L	0.2	1	0.6	0.4	0.2	<0.2	<0.2	<0.2	**0.40**
Copper (Dissolved)	µg/L	1	1	1	<1	<1	<1	<1	<1	**1.00**
Copper (Total)	µg/L	1	7	4	3	2	1	1	1	**2.71**
Lead (Dissolved)	µg/L	1	15	14	8	2	12	4	2	**8.14**
Lead (Total)	µg/L	1	420	207	143	56	78	51	26	**140.14**
Zinc (Dissolved)	µg/L	10	<10	<10	<10	<10	<10	<10	<10	**10.00**
Zinc (Total)	µg/L	10	25	17	12	<10	<10	<10	<10	**13.43**
C6 - C9 Fraction	µg/L	20	237	186	30	163	80	126	114.00	**133.71**
C10 - C14 Fraction	µg/L	25	56	80	40	57	29	61	48.00	**53.00**
C15 - C28 Fraction	µg/L	25	230	248	184	368	180	533	430.00	**310.43**
C29 - C36 Fraction	µg/L	25	45	53	46	45	<25	48	39.00	**43.00**
TPH (Total)	µg/L	95	568	567	300	633	314	768	631	**540.14**

M2

parameter	unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	26	25.8	25.7	25.7	25.4	25.3	25.5	**25.6**
pH	pH	0.1	7.8	7.8	7.5	7.5	7.5	7.4	7.3	**7.5**
Groundwater level	mPD	0.1	5.0	5.0	5.0	5.0	5.0	5.0	5.0	**5.0**
Cadmium(Dissolved)	µg/L	0.2	0.4	<0.2	0.3	0.3	0.3	<0.2	<0.2	**0.27**
Cadmium(Total)	µg/L	0.2	0.5	0.4	0.5	0.5	0.5	0.4	0.2	**0.43**
C6 - C9 Fraction	µg/L	20	126	116	<20	199	152	130	97	**120.00**
C10 - C14 Fraction	µg/L	25	78	64	59	84	102	97	73	**79.57**
C15 - C28 Fraction	µg/L	25	283	188	194	234	318	281	292	**255.71**
C29 - C36 Fraction	µg/L	25	46	26	29	39	44	41	52	**39.57**
TPH (Total)	µg/L	95	533	394	302	556	616	549	514	**494.86**

C1

parameter	unit	R.L	23-Jun-06	24-Jun-06	25-Jun-06	26-Jun-06	27-Jun-06	28-Jun-06	29-Jun-06	Average
Temperture	Degree	0.1	26.6	26.6	26.7	26.7	25.7	25.4	25.4	**26.2**
pH	pH	0.1	7.7	7.6	7.6	7.6	7.6	7.6	7.6	**7.6**
Groundwater level	mPD	0.1	2.4	2.4	2.4	2.4	2.4	2.4	2.4	**2.4**
Mercury (Dissolved)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Mercury (Total)	µg/L	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.50**
Cadmium (Dissolved)	µg/L	0.2	0.4	<0.2	0.4	<0.2	<0.2	<0.2	<0.2	**0.26**
Cadmium (Total)	µg/L	0.2	1	0.7	0.6	0.4	0.3	0.3	<0.2	**0.50**
Copper (Dissolved)	µg/L	1	<1	<1	<1	<1	<1	<1	<1	**1.00**
Copper (Total)	µg/L	1	5	4	3	2	2	2	2	**2.86**
Lead (Dissolved)	µg/L	1	21	20	8	4	7	6	4	**10.00**
Lead (Total)	µg/L	1	327	213	167	97	73	69	28	**139.14**
Zinc (Dissolved)	µg/L	10	<10	<10	<10	<10	<10	13	<10	**10.43**
Zinc (Total)	µg/L	10	39	30	23	15	21	30	12	**24.29**
C6 - C9 Fraction	µg/L	20	118	86	<20	46	37	46	26.00	**54.14**
C10 - C14 Fraction	µg/L	25	53	38	43	47	60	62	46.00	**49.86**
C15 - C28 Fraction	µg/L	25	342	215	249	425	528	530	580.00	**409.86**
C29 - C36 Fraction	µg/L	25	42	45	39	35	38	44	44.00	**41.00**
TPH (Total)	µg/L	95	555	384	351	553	663	682	696	**554.86**